020108

JPRS-UMA-86-066

20 NOVEMBER 1986

USSR Report

MILITARY AFFAIRS

FOREIGN MILITARY REVIEW

No 6, JUNE 1986

FBIS FOREIGN BROADCAST INFORMATION SERVICE

10
83
A05

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-UMA-86-066

20 NOVEMBER 1986

USSR REPORT

MILITARY AFFAIRS

FOREIGN MILITARY REVIEW

No 6, June 1986

Except where indicated otherwise in the table of contents, the following is a complete translation of the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, published in Moscow by the Ministry of Defense.

CONTENTS

Articles by Soviet authors and the chronicle were prepared from materials of the foreign press. The issue used illustrations from the reference work Jane's and the following journals: AVIATION WEEK AND SPACE TECHNOLOGY, JANE'S DEFENCE WEEKLY, JANE'S FIGHTING SHIPS, SOLDAT UND TECHNIK, INTERNATIONAL DEFENSE REVIEW, NATO'S SIXTEEN NATIONS, NAVY INTERNATIONAL, NATIONAL DEFENSE, PROCEEDINGS, FLIGHT INTERNATIONAL, AIR PICTORIAL.

6904/9835

ISRAELI STRATEGY, OPERATIONS IN LEBANON

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 3-9

[Article by Col Yu. Sedov and Col L. Yartsev: "Israel: On a Course of Aggression and Genocide (Some Military Results of Israel's Aggression in Lebanon)"; passages rendered in all capital letters printed in boldface in source]

[Text] Over 30,000 Lebanese and Palestinians, chiefly women, children and the elderly, were killed and some 70,000 wounded as a result of Israel's aggression against the Lebanese and Palestinian peoples which began in the summer of 1982 and which was codenamed "Peace for Galilee" in Tel Aviv. Thousands of people disappeared without a trace, around a million were left homeless, and dozens of populated points and Palestinian camps and many monuments of culture were destroyed. This was the bloodiest war in the Near East and it had a substantial effect on the situation in the region. Its sources, course and consequences are being carefully studied by specialists abroad.

Israel's military doctrine was implemented during the aggression in both its political and military-technical aspects. The content of the main (political) aspect, which rests on society's dominant ideology and policy of the ruling circles, was displayed to the full extent. Its essence is reliance on military force in attaining political goals. Zionism is the dominant system of views in the country; it is a chauvinist ideology and an aggressive military-political practice of the major Jewish bourgeoisie. Israel's policy, which determines the nature of its military doctrine, represents a consistent course toward expansion and aggression, toward expanding borders by seizing the territories of neighboring Arab states, and toward suppressing the national liberation movement in the region. It is a policy of a state which is the principal defender of the interests of the most militant circles of world imperialism in the Near East, and the United States above all. It was this policy which determined the tasks of aggression and methods of carrying them out.

The content of the military-technical aspect of military doctrine (methods of warfare, military organizational development, technical outfitting of the armed forces) is fully subordinate to Tel Aviv's aggressive goals. At its basis is the concept of a "blitzkrieg," which proceeds from the assumption that a protracted war against the Arabs is not within Israel's military and

economic capabilities. During the aggression in Lebanon, however, this concept suffered total failure above all because of the courageous resistance of armed detachments of the PLO [Palestine Liberation Organization] and Lebanese national-patriotic forces, and the bulk of the populace in the southern part of the country. The invasion of Lebanon, planned as a "lightninglike surgical operation," developed into the most lengthy war in the Near East which essentially continues to this day. As a result, for the first time in the history of the Middle East conflict, three years after the invasion the Israeli Army was forced to ignominiously leave almost the entire territory of Lebanon it had seized, under attacks by resistance forces.

Meanwhile, the concept of "limited war" adopted by Tel Aviv after the conclusion of the Camp David Accord in 1979 underwent a test during the Israeli aggression. By removing Egypt from the anti-Israeli front, this separate deal actually excluded for Israel the danger of conducting combat actions simultaneously against a broad coalition of Arab states as was the case in 1967 and 1973. Israeli General S. (Gazit) declared: "The agreement with Egypt is behind the invasion of Lebanon. If we had been unable to count on this agreement we would not have been capable of concentrating such large forces in the north and creating such a threat at the Lebanese-Syrian front."

The plan for outfitting the Israeli Army with weapons places primary reliance on the United States, which supplies its partner with the very latest kinds of weaponry. Almost 85 percent of Israeli aircraft (including 120 F-15's and F-16's), over half of the tanks (including 810 M60A1's and 650 M48's) and 90 percent of the artillery are of American production. The country has established a military-industrial complex which actually dictates Israel's policy. The state's industry essentially has been placed at the service of the military: it manufactures over 600 kinds of weapons and combat equipment and employs half of the industrial workers. The army devours 35 percent of the gross national product and more than 50 percent of the state budget.

The facts indicate that the invasion of Lebanon was planned and prepared in advance, with special attention given to reconnaissance, which directed main efforts at collecting valid data on the location and degree of combat readiness of enemy ground forces, about air defense weapons, the airfield network, control points and the system for supplying defending forces. Considerable measures were taken to camouflage the upcoming invasion. Dummy nets were established at permanent troop locations without changing the operating regime of communications equipment. Subunits in concentration areas were thoroughly camouflaged and some of them were moved out under the guise of exercises. There was extensive use of disinformation employing radio equipment, and a troop concentration was simulated on the Golan Heights. All these measures pursued the goal of concealing the time for the beginning of the aggression and the direction of strikes. Reliance was placed on surprise.

The Israeli Army's relatively rapid advance in the initial stage of the invasion also was facilitated by the fact that the Israelis continuously built up forces and resources on axes of main attack of the groupings, creating an overwhelming superiority over the enemy. The strength of advancing troops increased from 15,000 on the first day of the invasion to 100,000 and more on following days. The ratio of the Israeli Army's numerical superiority over Lebanon's defenders accordingly rose from 6:1 to 10:1. The command element

periodically carried out a scheduled troop rotation. Reservists were used actively: the bulk of reserve components of the armed forces "passed" through Lebanon.

From the first days of the intervention the Israeli Army employed the barbaric "scorched earth" tactics in Lebanon which the Americans had accomplished during the war in Vietnam. To reduce their personnel losses to a minimum, Israelis would subject populated points to many hours of bombardments from the ground, air and sea before an assault, essentially turning them into ruins. This led to an enormous number of victims among the civilian population.

Israeli Professor Ben (Porat) wrote: "The brutal bombings, considerable destruction and high number of victims among refugees and Lebanese residents were supposed to make it easier for the Israeli Army to occupy the territory with minimum losses. An amoral act thus was committed: in order to reduce our losses, the government displayed a readiness to subject the other side to terrible losses, including civilians and even Lebanese who were not participants in the war between Israel and the Palestinians. . . . Consequently, a principle of the most horrible morality was confirmed: Jewish blood is dearer than any other blood."

The offensive was conducted along three main axes: coastal (Tyre--Saida--Damour--Beirut), central (Nabitiya--Jezzine, moving to the Beirut-Damascus highway), and eastern (Hasbaiya--Rachaiya--Bekaa Valley, with a possible move to the Lebanese-Syrian border). There was no solid front line before the encirclement of Beirut.

Reinforced armored brigades operated in the first echelons on each axis. They would bypass strong centers of resistance and cities without being drawn into protracted fighting. Second echelon subunits blockaded and captured the centers of resistance and cities. Airborne and amphibious assault forces widely used by the Israelis carried out this same mission.

Methods of psychological pressure also were used during the blockade. The interventionists used leaflets and loudspeakers to suggest that the populace concentrate on the outskirts of cities in order, as was announced, to avoid victims among civilian residents. But those who believed these statements soon ended up in so-called "interrogation centers," and from there all Palestinians, members of Lebanese national-patriotic forces and their sympathizers were sent to concentration camps.

The GROUND FORCES played the principal role in accomplishing operational and tactical missions during the aggression. Their operating tactics were considerably influenced by the nature of the terrain, distinguished by the presence of mountains with steep slopes and narrow roads, and by the large number of populated points. The Israeli Army had no experience in fighting under such conditions, with the exception of the short-lived fighting in Jerusalem in 1967 and in the Suez in 1973.

Israeli Army tactics always were based on a swift advance, surprise, and commanders' initiative. Missions of seizing key objectives deep in the enemy rear with a subsequent sweep of captured territory by infantry subunits were brought to the foreground. Therefore during preparations proper attention was

not given to training infantry capable of conducting combat actions in dismounted formation independently and over a lengthy time.

As foreign specialists note, however, the army in Lebanon was faced specifically with that need; there it was incapable of effectively waging protracted fighting in which the infantry would be the main striking force supported by tanks and artillery. Urban and mountain conditions limited troop mobility, hampered the execution of a maneuver to concentrate efforts on threatened axes, and complicated command and control of the subunits during combat.

The terrain favored holding a defense and hampered the actions of Israeli ground forces, which were not ready to fight under mountain and urban conditions. "The absence of mountain infantry subunits and infantry capable of conducting independent combat actions in populated points and the mountains meant that the Israeli Army was in a very difficult situation," wrote American military specialist Richard A. Gabriel in his book "Operation Peace for Galilee: The Israeli-PLO War in Lebanon."

In the opinion of foreign experts, the experience of Israeli Army combat actions in Lebanon showed that only small subunits could operate successfully under mountain conditions and in the city, since the deployment of large units is hampered here. The rapid movement of reserves and assistance from neighboring units most often was limited or impossible. Tanks were capable of fighting usually in the combat formations of motorized infantry subunits. Tanks subunits and units could be employed at full strength to defeat an enemy on approaches to cities or in the foothills in a turning movement for the purpose of sealing off the enemy.

Fighting which unfolded in cities and mountains also showed that infantry subunits had to take the brunt of an advance. Such operating tactics force the enemy to reveal his ambushes before tanks and APC's are committed. But in Lebanon, wrote the foreign press, the Israelis adhered to tactics of the 1973 war which called for support of tanks by infantry, and so the enemy set up ambushes and imposed combat where it was favorable to him. The swift advances and attacks typical of Israeli tank forces essentially were impossible to employ. Tank subunits often broke up and lone tanks would move along mountain roads and city streets actually without any cover.

The war in Lebanon was the first test under combat conditions of the Israeli Merkava tank. Two hundred of Israel's 1,240 tanks which participated in the aggression were of this make.

The Merkava proved to be resistant to catching fire because it used a fire extinguishing system having high speed and effectiveness to reduce the behind-the-armor effect of ammunition, especially shaped charges. There was a 13 percent likelihood that a round would penetrate into the fighting compartment, and only every seventh hit caused a fire inasmuch as forward positioning of the engine-transmission compartment, isolated from the fighting compartment by an airtight armored bulkhead, is used in the tank for crew protection.

On the whole, however, in the assessment of the American journal MILITARY REVIEW, the effectiveness of Israeli tank actions in Lebanon was lower than in 1973, which was noted to have been caused by unfavorable terrain conditions. The narrow winding roads permitted enemy subunits equipped with antitank rocket launchers to conduct aimed fire against the Israeli tanks from cover. There were 140 Israeli tanks knocked out in Lebanon (primarily the M60 and Centurion), 40 of which along with 135 APC's were not restorable. All vehicles were destroyed by the fire of antitank weapons. Several damaged Merkava tanks were returned to action. There were very few tank actions in which combat vehicles of both sides took part.

A number of western journal publications which referred to the opinion of some representatives of the Israeli command pointed out plans for conducting a partial reorganization of Israel's tank forces and for revising their operating tactics with consideration of the experience of the aggression in Lebanon and in the context of a future war, above all with Syria.

The effectiveness of Israeli artillery actions also was reduced due to the nature of the theater of military actions, which constrained its maneuverability. Artillery, and above all the self-propelled 155-mm and 175-mm howitzers, played a decisive role in blockading cities, especially Beirut, when massed fire was conducted against area targets, including with the use of incendiary shells. The automated David system was widely employed for target designation.

It is believed that antiaircraft weapons used to combat ground targets gave a good account of themselves. For example, the Israelis widely used the Vulcan 20-mm six-barrel antiaircraft gun mounted on the M113 APC. Engineer troops received a positive evaluation from the command element. They built and restored 400 km of roads and built bridges across the Litani and Zaharani rivers. Tank-mounted minesweeping equipment was the most actively used engineer equipment.

The Israeli AIR FORCE played an important role in ensuring achievement of the goals of aggression in Lebanon. It carried out missions of winning air superiority, providing close air support to ground forces, and preventing the approach of reserves by destroying air defense weapons, control points, combat equipment and personnel. In addition, the Air Force supported the actions of airborne and amphibious assault forces and carried out electronic and visual reconnaissance for all branches of the armed forces. The Air Force was employed comprehensively and its command and control was centralized during the accomplishment of these missions. Air combat actions were conducted both in hours of daylight and darkness with the performance of thorough reconnaissance of targets planned for destruction. Jamming equipment was actively employed. Demonstration flights of large groups of aircraft at medium altitude with the concealed presence of attack groups at low altitude beyond the coverage of the opposing side's radar equipment were widely practiced.

In addition to conventional RF-4E and EV-10 tactical reconnaissance aircraft, four communications intelligence and electronic intelligence aircraft created on the basis of the Boeing 707 and C-130 transports and four E-2C Hawkeye AWACS aircraft were used for aerial reconnaissance missions. In addition,

balloons and unmanned flying craft as well as ground reconnaissance posts and centers equipped with appropriate gear were widely used during the aggression. All these components were brought together in a unified system for collection, processing, transmission and display of data.

Western specialists believe that the Israeli-developed Scout and Mastiff remotely piloted vehicles [RPV's] demonstrated high effectiveness in performing reconnaissance. They were used for a lengthy time preceding the aggression to perform aerial reconnaissance of the territory of Lebanon. With the beginning of combat actions their sphere of use expanded considerably. Israeli Army commanders at all levels received a real battlefield situation display and were able to coordinate combat actions of the Air Force and ground troops because of the unmanned reconnaissance aircraft.

Forward air controllers would vector strike groups to targets selected for destruction and then would evaluate strike results by means of the Scout RPV's. Some of the unmanned vehicles, fitted with a laser rangefinder/target designator, supported the use of guided weapons with a laser homing system. In addition, unmanned aircraft fitted with electronic warfare equipment were used for electronic suppression of emitters on Lebanese territory. They were often used as dummy targets for disorganizing the operation of this equipment.

The unmanned reconnaissance aircraft drew special attention of specialists from the United States and NATO. In the opinion of western strategists, their advantages for European conditions are that they are capable of performing reconnaissance not only of the battlefield, but also of enemy second echelons. The capabilities of unmanned flying craft demonstrated during the Israeli aggression meet the so-called "Rogers plan" adopted by NATO, which provides for delivering preemptive strikes against Warsaw Pact forces to the entire depth of their operational alinement, including second echelon forces. In early 1986 the United States announced the purchase of the first lot of Israeli unmanned aircraft. It is apparent that there is an adjustment of militarist cooperation between Israel and western countries, which are seeking to use Tel Aviv's military experience for implementing plans of aggressive wars against Warsaw Pact countries and in local conflicts.

The West's interest in results of the test of other weapon systems also must be examined from this same standpoint. The foreign press announced in particular that individual components of reconnaissance-attack systems were used during the aggression. They also are to become an important means for implementing the "deep strike" concept. These components might include the aforementioned Boeing 707 aircraft as a means of detection and target designation, as well as guided aerial bombs dropped by F-4E Phantom aircraft before entering the zone of detection by the other side's air defense.

A considerable portion of all aircraft-sorties of the Israeli Air Force during the aggression was spent on providing close air support to ground forces. The American-made Skyhawk ground attack aircraft is the basic Israeli aircraft intended for actions against ground targets. The diversity of its armament, the rather large combat payload, and the acceptable cruising speed are noted. In a number of cases there was air alert to reduce the time for ground attack aircraft to arrive on call at the forward edge. In addition to the attainment of surprise (flights at extremely low altitude), the tactical arsenal of these

aircraft included dummy passes at a target at the limit of the range of air defense weapons with a subsequent attack from the rear; a demonstration group's diversion of antiaircraft fire to itself; attacks from different directions (to dissipate air defense fire); execution of evasive action, and so on.

Israeli aviation widely used antipersonnel [sharikovyye] and plastic bombs and antipersonnel mines. One ground attack aircraft would take some 1,000 antipersonnel bombs, each embedded with 250 metal balls 5-6 mm in diameter which would disperse over an area of almost 20,000 square meters. The balls would strike people on open terrain and penetrate deeply into the body and were difficult to remove. A plastic bomb would explode into hundreds of pieces from 1.5 to 3 mm in size. The fragments could not be detected in the human body by x-ray, which greatly hampered the treatment of wounded.

The aforementioned ammunition was used most often in clusters, which would be dropped from a height of 400-600 m. They usually were used to deliver strikes against positions of AAA batteries and missile complexes to put the attendant personnel out of action as well as the sensitive elements of guidance radars and other electronic gear.

From the first days of the siege of West Beirut the aggressor widely used phosphorus bombs and shells, which inflicted especially painful suffering on victims. American journalist Loren Jenkins bears witness: "Many 155-mm rounds found among the ruins were covered on the inside with a yellowish-orange oxide, and the caustic odor of phosphorus was impossible to confuse with anything else."

An appeal of the International Commission for Investigation of Israeli Crimes Against the Lebanese and Palestinian Peoples to medical personnel of the world stated: "The contents of phosphorus bombs ignite easily and have high toxicity. When the bomb bursts it disperses, transforms into a liquid state, ignites and moves with high speed over a certain area. It penetrates the body and continues to burn, obtaining oxygen from human tissues. A person experiences acute sensations of pain and his life is in extreme danger during the action of phosphorus on the body and during the treatment of such wounds. The phosphorus continues to smolder within the human body for several hours after the onset of death. Cases are known where phosphorus continued burning for up to three days."

The use of phosphorus and cluster bombs led a very high mortality rate among the wounded. During the Israeli invasion in the spring of 1978 the mortality rate was from 15 to 20 percent during the operations, but it reached 50 percent in 1982, according to data of the British newspaper GUARDIAN.

An American fuel-air explosive bomb ("vacuum bomb") was tested in Beirut. A total of seven such weapons were dropped, and three of them were duds. The "vacuum bombs," with combat characteristics close to the capabilities of tactical nuclear weapons, caused enormous destruction in the city and a large number of civilian residents were victims.

The Israeli command regarded the winning of air superiority as a necessary condition for successful combat actions by all branches of the armed forces.

Destruction of enemy aircraft in the air by fighters was one of the chief methods of accomplishing this mission. Israel made extensive use of four E-2C Hawkeye AWACS aircraft purchased in the United States to search for and detect targets in Lebanese air space. It was used for the first time as an airborne command post in aerial combat over Lebanon in June 1979.

The use of E-2C Hawkeye aircraft by the Israeli Air Force in 1982 permitted detecting enemy fighters in a number of cases immediately after their take-off. But tracking of the fighters could cease after they entered a "blind zone" not covered by on-board radar due to the effect of the terrain's mountainous relief. In such cases F-15 fighters would move forward and cover this zone with their own radars. Constant surveillance of the air situation in the battlefield area thus was accomplished.

The aircraft's flight was concealed from enemy radar surveillance by active or passive jamming. Active jamming was accomplished from air alert zones by EW aircraft, from mobile ground stations, and from aboard combat aircraft equipped with appropriate gear. A Boeing 707 EW aircraft refitted from a passenger liner was used most widely as a barrage jamming platform.

Passive jamming was accomplished by special aircraft which would create a "camouflage shield" between friendly fighters being sent into combat and the enemy. As a rule the Israeli jammer aircraft would drop chaff at high altitude in the morning hours so that the cloud which formed descended and shifted by air currents to the combat zone by the time the fighters arrived there.

In the overwhelming majority (over 65 percent) of instances the Israeli fighters employed the Sidewinder short-range guided missiles as weapons, and the launches of Sparrow medium-range guided missiles were made in less than 28 percent of the cases, most often without result. Consequently, close aerial combat was the basis of all fighter combat activities and the principal means for their attainment of air superiority.

The use of the Israeli NAVY in combat actions in Lebanon was of a limited nature. It primarily accomplished missions in support of ground forces operating on coastal axes, landing assault forces from the sea, neutralizing strongpoints on the Lebanese coast, patrolling the coastal zone and delivering troops and logistics. It essentially experienced no opposition from the enemy. For the first time in the Arab-Israeli conflict the Israeli Navy worked closely together with ground forces and the Air Force in this war.

A grouping of the Israeli Navy landed an assault force in Saida at the beginning of combat actions. Its objective was to cut off enemy detachments, cut their communications with Beirut and demoralize them with the threat of encirclement from the north. Escorted by guided missile patrol boats and motor patrol boats, the landing detachment put to sea before the beginning of the invasion. The detachment already was near Saida when ground forces invaded Lebanese territory on 6 June. The assault force began landing at a time when troops were fighting 40 km from the city. Marines supported by parachutists seized a beachhead in the first wave. The movement of infantry and tank subunits from the landing ships began several hours later. The landing was supported by bombers and by artillery bombardments from the boats.

A second wave of the amphibious force landed on the following day. The landing ships moved more than 400 tanks and vehicles in just the first week of fighting. Guided missile patrol boats provided fire support to attacking ground forces north of Saida and at the same time ships sealed off the coast from the sea. On the whole, the Israeli Navy provided substantial support to ground forces operating on the coastal axis.

The Israeli command drew up a program for developing the country's Navy with consideration of the experience of the war in Lebanon. It ordered guided missile hydrofoils armed with the Harpoon and Gabriel PKRK [antiship missile systems] in the United States. It is planned to build new submarines (the project was developed in the United States) and to replace obsolete American-made landing ships with new ones with large displacement.

In conducting a policy of aggression and genocide toward the Lebanese and Palestinians during the intervention in Lebanon, the Tel Aviv militarists showed themselves to be a tool of international imperialist circles attempting to crush the just struggle of Arab peoples for freedom and independence and establish undivided control over the region. But, relying on broad support on the part of the USSR and other socialist countries, peoples of the Arab East are giving a worthy rebuff to the forces of imperialism and Zionism.

6904
CSO: 1801/246

U.S. ARMY SPECIAL FORCES

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 15-22

[Article by Col S. Semenov; passages rendered in all capital letters printed in boldface in source]

[Text] The present American administration's policy of international terrorism and strengthening of military preparations, including large-scale measures to build up the combat might of armed forces, also provides for the improvement and increase in numerical and fighting strength of special purpose units and subunits included in all three branches of the Armed Forces.

The foreign military press reports that their primary purpose in peacetime is to prepare conditions and directly participate in arranging acts on the territories of sovereign states for overthrowing governments unsuitable to the United States or assisting pro-American regimes in their struggle against progressive domestic actions; perform subversive acts and acts of sabotage, kidnapping or murder of prominent political, state and military figures; seize hostages; collect intelligence; and liberate their own citizens and prisoners of war. In addition to these missions, in wartime they are assigned to conduct reconnaissance and subversive operations in the enemy rear and to collect intelligence for U.S. Armed Forces groupings in a TVD [theater of military operations]. They also may be assigned missions to destroy important strategic installations both in the deep enemy rear and in his operational-tactical depth (state and military control points, communications centers, command posts, nuclear attack weapons, nuclear weapon depots, rear military installations, bases and airfields of the air force and navy, seaports and so on); to vector friendly aircraft to such installations and adjust the fire of missile-artillery weapons; to disrupt lines of communication and disorganize the work of the rear; and to carry out psychological operations. Special Forces personnel have a high degree of physical and professional training in survival under extreme physical-geographic conditions; they are trained in parachuting under all weather conditions day or night, and in sniping fire and demolitions, including the use of small nuclear mines as well as toxic and bacterial agents.

The Joint Chiefs of Staff [JCS] exercise overall operational command and control of Special Forces units and subunits on behalf of the supreme

commander of the Armed Forces (the U.S. president) and secretary of defense through commanders in chief of the U.S. Armed Forces in the zones. In January 1984 a Joint Special Operations Agency was created under the JCS; it draws up specific recommendations and draft plans for their tactical employment. Immediate operational control of Special Forces in a theater in wartime is exercised by commanders of operations units [soyedineniye] and joint tactical special purpose groups created to accomplish specific missions, and by the commanders and staffs of these units [chast] and subunits.

The U.S. military-political leadership views the Special Forces as an effective tool for achieving their goals in peacetime, when the employment of conventional armed forces is regarded as premature or inexpedient for political considerations. Based on this, the U.S. military-political leadership uses them both in various local conflicts and undeclared wars of American imperialism against other peoples, and for secret intervention in the affairs of sovereign states. For example, they were widely employed in the American aggression in Indochina, in the invasion of Grenada, and in the attempt to free the American hostages in Iran in April 1980. According to foreign press reports, they take an active part in preparing and carrying out acts of banditry on territories of Nicaragua and Afghanistan as well as in other parts of the world. They help train special subunits of armed forces of countries with reactionary pro-American regimes and of other developing states under the guise of military-economic assistance. According to foreign press data, the overall strength of the Special Forces is 32,000 persons: 14,900 are in the regular forces and 17,100 in reserve components. Their inventory includes more than 300 specially outfitted aircraft and helicopters, some 120 launches and various water craft, mortars, recoilless guns, rocket launchers and other antitank weapons, machineguns, automatic and sniper rifles, special mines (including small nuclear mines with a yield of from 0.01 to 0.1 KT), toxic chemical agents and bacterial agents, and small radios providing two-way communications via artificial earth satellite over a distance of more than 3,500 km.

This article examines U.S. Army Special Forces, which are the largest component of the country's special forces capable of accomplishing practically the entire range of missions assigned them.

SPECIAL FORCES ORGANIZATION. As the western military press reports, Army special forces are placed in the 1ST SPECIAL OPERATIONS COMMAND (Fig. 1), subordinate to the U.S. Continental Army Command and through it to the U.S. Army staff. It is responsible for comprehensive training and logistical support of the units and subunits which make it up, and it assigns necessary formations to commanders in chief of American Armed Forces in the zones by direction of the JCS and Army Staff. The command element basically exercises administrative control of such forces and takes part in preparing plans for their tactical employment and for comprehensive support of special operations. In certain instances the preparation and operational control of these operations may be assigned to the 1st Command's operations center or to a forward operations control group formed from the command in conducting local special operations under plans of the supreme U.S. military-political leadership in remote and isolated parts of the world. The command closely coordinates with corresponding subunits of the Navy and Air Force staffs as

well as with the CIA, USIA and other American special departments in matters of training and specifics of tactical employment of Special Forces.

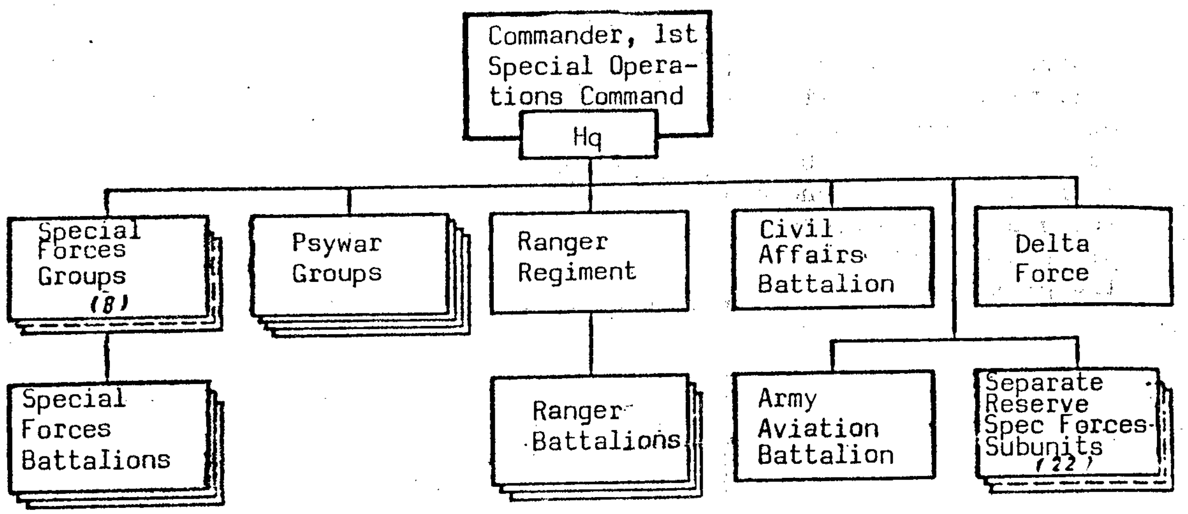


Fig. 1. Organizational structure of U.S. Army 1st Special Operations Command

The Army Special Forces comprise the bulk of all special-purpose formations of the American Armed Forces. They have 22,400 persons, including 9,100 in the regular Army and 13,400 in reserve components. They include eight special forces groups (four are in the regular Army and four in the National Guard and Army Reserve), four "psychological warfare" groups (one in the regular Army and the others in reserve components), a Ranger Regiment, civil affairs units and subunits of the regular Army and reserve, an Army aviation battalion, Delta Force, nine group (brigade) staffs and 22 separate companies of reserve civil affairs formations.

The Special Forces also include separate deep reconnaissance companies of Army corps which are assigned to conduct reconnaissance and carry out subversive acts in the enemy's operational-tactical depth.

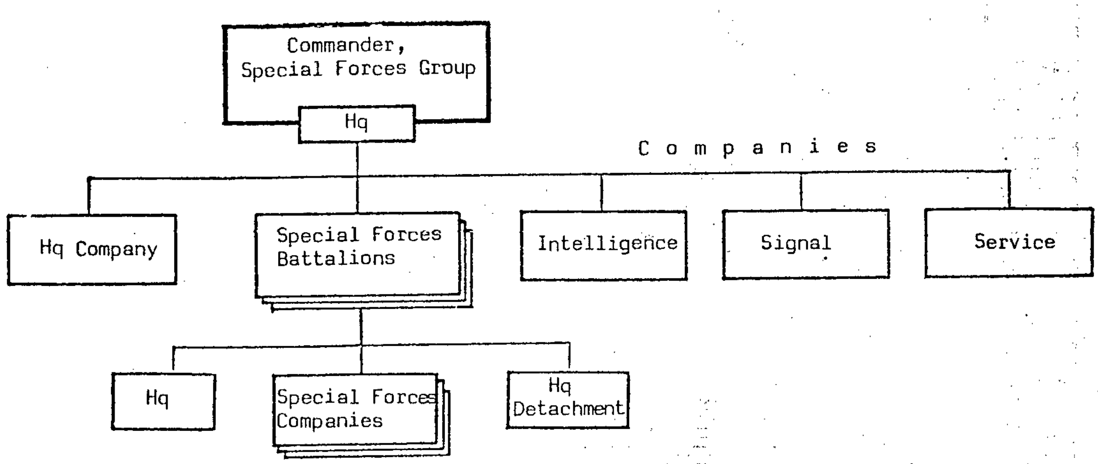


Fig. 2. Organization of U.S. Army special forces group

The SPECIAL FORCES GROUP (Green Berets) is intended for conducting operations on the territories of other countries or in the enemy rear for the purpose of carrying out coups d'etat, murders or kidnappings of prominent state, political and military figures, as well as the organization of "rebel and guerilla actions," destroying or putting important installations out of action, and disorganizing state and military control. It includes a headquarters and headquarters company, three special forces battalions and three companies--intelligence, signal and service (Fig. 2).

The special forces battalion (over 250 persons) includes a headquarters, headquarters detachment and three companies, each of which consists of a headquarters detachment and six operations detachments (12-14 persons), which are the basic subunits of special forces. Personnel undergo training in the detachments for conducting special operations. Detachment personnel directly engage in training "guerilla" formations (numbering up to 500 persons) on enemy territory or in the enemy rear, and carry out subversive and other operations together with them or independently. The strength of the special forces company is around 90 persons.

The intelligence company has the mission of collecting and processing intelligence in the interests of assuring the security of operations by subunits of the special forces group and for performing counterintelligence functions and electronic warfare [EW] measures. It includes intelligence teams, including for communications intelligence and EW, counterintelligence, communications security, and intelligence analysis and processing.

The signal company deploys the special forces group's communications center and provides internal communications at the special forces operations base. It is also capable of conducting medium repair of communications equipment with its own resources and limited photographic support to the needs of group subunits. It includes a headquarters, two operations signal platoons, a support and communications equipment repair platoon, and a photographic section.

The service company handles logistical, transport, medical and "limited" aviation services of the special forces group's subunits. It has a headquarters and four platoons: logistics, medical, administrative services and aviation service.

The regular Army special forces group has a total of from 800 to 1,100 persons (the authorized strength is up to 1,500 persons), over 120 rocket launchers, up to 400 demolition devices including small nuclear mines, six Army aviation aircraft and helicopters, and around 100 vehicles. Up to 60 detachments each numbering 12-14 persons or up to 100 teams of 7-8 persons each can be formed from the group and can be sent into the enemy rear to a depth of up to 3,500 km.

As the foreign military press reports, four regular Army special forces groups are stationed on U.S. territory (the 5th and 7th at Fort Bragg, North Carolina; the 1st at Fort Lewis, Washington; and the 10th at Fort Devens, Massachusetts). Three of their battalions (one each from the 1st, 7th and

10th groups) are stationed on Okinawa, in Panama and in the FRG respectively. In addition, one special forces company is stationed in West Berlin and South Korea. These subunits train purposefully in peacetime for actions in the rear of advancing enemy forces in case war begins. In addition, it is planned to leave them on enemy-occupied territory to conduct special operations against enemy control organs, rear installations and lines of communication.

As the foreign press attests, these groups are assigned in peacetime to likely areas of tactical employment and their personnel undergo appropriate training and are included in various American Armed Forces exercises in these areas.

The "PSYCHOLOGICAL WARFARE" GROUP has the mission of training the necessary number of subunits and assigning them to the corresponding commander of American Armed Forces in the theater or the combined-arms commander for organizing and conducting "psychological operations" in his zone of responsibility. Foreign military specialists note that their basic missions are the preparation and dissemination of propaganda materials for various purposes among enemy servicemen and the civilian population to influence their moral-political state, to carry out disinformation and so on.

The group has no fixed organization and is manned by subunits according to the strength and objective requirements depending on plans for its employment. It can include three or more battalions each numbering some 200 persons, and several separate companies and teams. It can have a total of 600 or more persons, basically professional propagandists (provocateurs) as well as specialists in preparing and manufacturing appropriate materials.

Group subunits are outfitted with printing equipment; movie, television and photographic equipment; mobile radio and television stations; loudspeaker units and other equipment.

The "psychological warfare" group usually is made operationally subordinate to the CIC of U.S. Armed Forces in a zone (in a theater). A "psychological warfare" battalion may be attached to an Army corps for the time of an operation, and up to a company from the battalion attached to the corps may be attached to a division operating on a separate axis.

The 75TH RANGER REGIMENT (BLACK BERETS) is intended chiefly for conducting reconnaissance-subversive and raiding operations in the enemy rear in wartime or during a local military conflict in peacetime.

The regiment (the headquarters is at Fort Benning, Georgia) has a headquarters, headquarters company and three Ranger battalions, a total of approximately 2,000 persons. The battalion (660 persons) includes a headquarters, headquarters company (around 50 persons) and three Ranger companies (180 persons each), each of which consists of a headquarters, three infantry platoons and a weapon platoon (Fig. 3). The battalion has a total of nine Dragon PTRK [antitank missile systems], six 60-mm mortars, over 500 automatic 5.56-mm rifles, 27 7.62-mm machineguns, 60 M203 antipersonnel rocket launchers, six 7.62-mm sniper rifles, as well as over 50 radios and some 100 pieces of special radio equipment.

The American command does not recommend employing the regiment at full strength. The Ranger battalion is the basic fighting unit. It can be subordinated to the commander of an Army group or of an Army corps and it can operate as part of a special forces operational formation in a theater for accomplishing missions in the interest of the entire grouping of American forces in the theater. Up to 60 sabotage-reconnaissance teams of 6-7 persons each can be formed on the basis of the battalion, capable of making raids in the enemy rear to a depth of up to 450 km with the following missions: collecting intelligence; knocking out important installations; disrupting lines of communication; disorganizing command and control, communications and the work of the rear; arranging ambushes and so on. In accordance with the "air-land operation (battle)" concept adopted by the United States, larger Ranger subunits or the battalion at full strength may operate in the enemy rear to prevent or delay the advance of his second echelons and reserves and deliver strikes against control points and important rear installations.

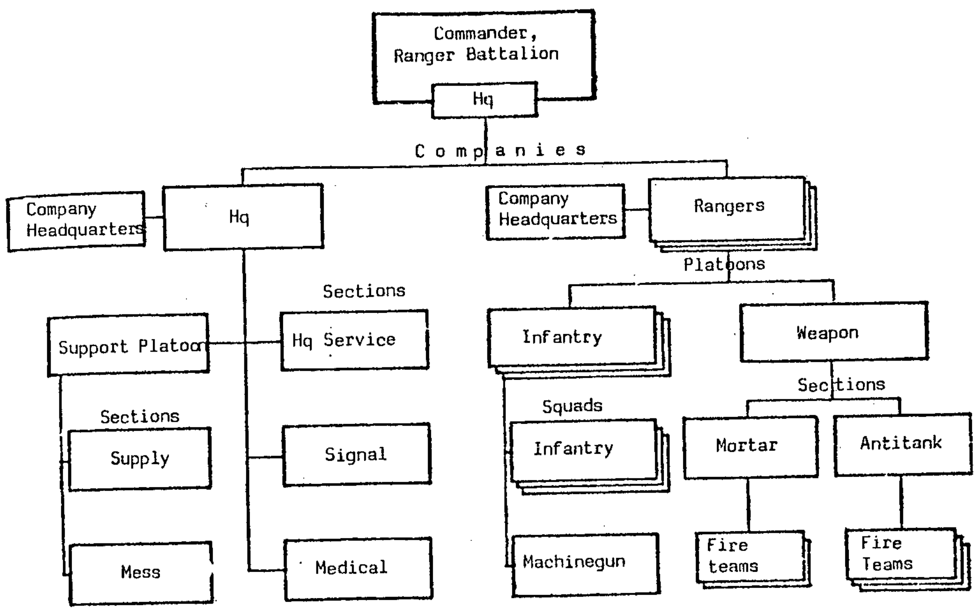


Fig. 3. Organization of the U.S. Army Ranger battalion

CIVIL AFFAIRS UNITS AND SUBUNITS are special formations of the Special Forces. They have a peacetime mission of giving practical assistance to pro-American regimes and authorities of certain developing states in adjusting the system of state and administrative control in U.S. interests. They are assigned missions of organizing and maintaining communications with local authorities of countries allied with the United States on whose territories American forces are located, for the purpose of comprehensive support of such authorities with necessary material and other resources.

In countries regarded as potential enemies, the forces and resources of these units secretly conduct operations to loosen and undermine the system of state and administrative control in order to weaken a specific state from within. In wartime these formations also are assigned functions of establishing regimes of administrative control on territories occupied by American troops.

The operations carried out are closely tied in with the American leadership's overall military-political and diplomatic acts in the international arena and with strategic and operational plans of Armed Forces commands in the theater, and are carried out in close coordination with the operations of other components of the Special Forces, especially with actions of "psywar" units and Green Berets.

Organizationally, these units and subunits presently are represented by the regular Army's 96th Civil Affairs Battalion (Fort Bragg), nine group headquarters and 22 separate companies of the Army Reserve. The battalion (more than 200 persons) includes a headquarters, headquarters company and 3-4 special companies.

One or more civil affairs groups each consisting of 3-4 battalions may be operationally subordinate to the CIC of U.S. Armed Forces in a theater during combat actions, and a battalion may be subordinated to the Army corps commander. Civil affairs subunits may be included in operational formations or formations of special forces tactical groups in a theater.

The 160TH ARMY AVIATION BATTALION (Fort Campbell, Kentucky) has the mission of air movement of special subunits to areas where they are to conduct operations in the enemy's operational-tactical depth, fire support of their actions, and combat and logistical support. It includes a headquarters, headquarters company, service company and three helicopter companies. It has a total of some 500 persons and over 60 helicopters of various types. Organizationally it is a part of the 101st Air Assault Division.

The DELTA FORCE (Fort Bragg) is a special kind of formation which accomplishes missions by direction only of the supreme U.S. military-political leadership. Officially it is called a force to "combat terrorism." At the same time, the experience of its employment in the abortive operation to free American embassy personnel in Iran in 1980 and in the U.S. aggression on Grenada in 1983 shows that "combating terrorism" is only a cover to camouflage the true purpose of this "elite" subversive subunit. For example, the foreign press has reported that during the aggression against Grenada the force was secretly landed on the island two days before the beginning of the invasion by the main body of American troops. Its primary mission was to capture key installations and terrain sectors to support the successful landing and immediate actions of the main body of the aggressor's airborne and amphibious assault forces.

The strength of the Delta Force is over 200 persons. They are volunteers specially chosen from among Special Forces servicemen.

PRINCIPLES OF COMBAT EMPLOYMENT. According to foreign military press information, combat actions of special forces usually are in the form of special operations which are closely tied in with each other by objectives, place and time and usually are conducted under a unified plan in strict conformity with the military-political course of the supreme U.S. military-political leadership. These operations often are carried out in secrecy even from governments of countries allied with the United States on

their territories under the guise of giving them military, military-economic and other forms of "assistance." Such operations also are carried out to support actions by groupings of American forces in the theater. American military specialists include the following operations among them:

--Strike-sabotage operations of the Green Berets and Ranger subunits against especially important strategic objectives in a theater of war (theater of military operations);

--Sabotage-reconnaissance operations of Ranger subunits in the operating zone of a combined-arms unit [soyedineniye] (formation) or a grouping of U.S. Armed Forces in a theater;

--Actions by Ranger subunits and deep reconnaissance subunits of the troops in the interests of Army corps and divisions in an "air-land operation" to collect intelligence, arrange ambushes on routes of advance of enemy second echelons (reserves), and destroy nuclear attack weapons, control organs and rear installations.

A special forces operations unit [soyedineniye] may be established to accomplish large-scale missions in the interests of the entire grouping of U.S. forces in a theater in wartime. The operations unit includes 1-2 special groups, 1-2 Ranger battalions, up to a "psywar" group, civil affairs subunits as well as several special forces air squadrons of the Air Force. During actions in coastal sectors the commander of this unit usually will have appropriate naval special forces operationally subordinate to him. The overall size of such a unit may exceed 4,000 persons. More than 300 detachments and groups may be assigned from it to conduct operations in the enemy rear.

Joint special tactical groups (some 1,500 persons) composed of one or two special forces battalions and support subunits, including from the Air Force, may be established to accomplish missions on an operational-tactical scale. The group may assign some 40 detachments numbering 6-14 persons each for actions in the enemy rear to a depth of up to 450 km.

PERSONNEL TRAINING of special forces is accomplished in two phases: individual and subunit.

INDIVIDUAL TRAINING basically is conducted at a special training center at Fort Bragg, where there are two schools: a Special Forces School and a school for training military advisers for giving assistance to foreign states. In addition, individual training classes for the personnel of special units also are conducted at the Ranger training center at Fort Benning and in Army infantry schools.

At the Special Forces School personnel undergo training in reconnaissance and sabotage in the enemy rear, in organizing and directing a "rebel" movement and "guerilla" detachments, in methods of employing special techniques, and in subunit operating tactics. The program includes parachute training, intensive physical and medical training, study and use of small arms (including basic foreign models), demolitions and skindiving, guerilla operating tactics,

foreign languages, morals and customs of the country (or group of countries in a region) of possible operational assignment, topography, radio work, methods of survival under extreme conditions, methods of penetrating into the enemy rear and moving to friendly (neutral) territory after completion of an operation, hand-to-hand combat techniques, and firing at night and under conditions of poor visibility by sound.

The individual training course is distinguished by high intensity and great physical and mental stresses. The physical training program, for example, provides for a daily 10 km forced march with a 32 kg pack and a 30 km forced march at the conclusion of the course. Training in radio work presumes bringing out the capability of a communications specialist (at the completion of the course) for receiving and transmitting at least 18 Morse code characters per minute by ear, using ciphers and codes, and using foreign-made radio equipment. All Special Forces personnel receive the knowledge and skills for calling in and adjusting artillery fire and for calling in and vectoring air support aircraft and helicopters. Great emphasis is placed on the study of foreign languages (one or more), methods of interrogating prisoners, and survival in various situations. Techniques and methods of obtaining food and water under desert conditions, moving in the mountains and lighting smokeless fires are practiced.

The majority of classes are conducted in the field and at night. The general individual training course takes 58 weeks, including 20 weeks for radio training and 10 for demolitions.

SUBUNIT TRAINING takes in the full range of special forces actions in operations and is conducted throughout the serviceman's service with high intensity. As a final test a trained operations detachment (12-14 persons) is parachuted onto unfamiliar or remote terrain or terrain that is complex in physical-geographic conditions. The personnel have weapons, explosives and other special gear along. In a period of 10-15 days the detachment has to move to a guarded objective indicated on a map and destroy it.

The training of Special Forces subunits for actions under arctic conditions is done at Fort Greely in Alaska, and training for jungle operations is done at Fort Sherman and Fort Gulick in Panama.

The combined-arms program in training schools for Rangers and deep reconnaissance personnel is similar to that discussed, but takes 8-10 weeks.

On the whole the Special Forces represent formations of professional saboteurs, provocateurs, demolitions personnel and murderers who in their moral, political and personal qualities fully conform to those missions and objectives assigned them by the U.S. military-political leadership.

6904
CSO: 1801/246

TANK DEVELOPMENT TRENDS ABROAD

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 22-29

[Article by Col B. Safonov, candidate of technical sciences; passages rendered in all capital letters printed in boldface in source]

[Text] A special place is held by tanks among traditional means of warfare, the development of which is greatly emphasized abroad. Tanks are considered the physical basis of armored and mechanized troops which gives the latter the capability of conducting highly mobile combat actions under conditions of the use both of conventional and nuclear weapons. U.S. and NATO militarists regard tanks as an important means of implementing their aggressive plans.

A rational combination of firepower, protection and mobility in tanks made them a necessary combat resource in modern warfare and convinced military specialists that there is no alternative to tanks either now or in the foreseeable future. This explains the fact that capitalist countries are taking steps to increase the size of tank inventories and are working on their quality improvement by modernizing existing models and creating new ones.

Foreign specialists note that the armament system of ground forces presently is characterized on the one hand by a constant improvement in tanks and an increase in their numbers and, on the other hand, by the rapid development of antitank weapons, as reflected in their expanded nomenclature and numbers and an increase in their effectiveness. In recent years, for example, there has been a significant increase in the capabilities of aviation and field artillery, which are general purpose weapons, for destroying tanks and other armored equipment. Aviation can employ guided and unguided bombs, clusters and missiles as well as small-caliber automatic guns against tanks. Antitank helicopters have become widespread. Tube field artillery is receiving new ammunition in the inventory (including Copperhead guided projectiles) providing a rather high tank kill probability at long ranges of fire. Special antitank ammunition also is being created for multiple launch rocket systems. Nuclear weapons acquired a clear-cut direction in the fight against tanks after the appearance of neutron ammunition.

Foreign specialists note particularly substantial progress in the development of specialized antitank systems. This is occurring both along the lines of an increase in accuracy of fire, range of fire, power of warheads and quick

response as well as along the lines of creating fundamentally new weapons for destroying tanks and other armored equipment at great distances from the forward edge. They include in particular terminally guided destructive submunitions of cluster warheads of missiles being developed in the United States under the Assault Breaker program, as well as the Copperhead 155-mm guided projectile (already in the inventory) and the SADARM 203.2-mm antitank cluster projectile.

In the opinion of foreign specialists, an improvement in means of combating tanks leads to a complication of the conditions of tanks' tactical employment and leaves its imprint on their design improvements. This is reflected in the fact that the key problem in further tank development has become one of improving their survivability, i.e., the feature of preserving or quickly restoring their combat effectiveness under conditions of enemy pressure. At the same time these specialists emphasize that, first of all, the problem of increasing survivability is not purely a tank problem but is typical of the entire system of armaments and military equipment of ground forces; and secondly, an increase in tank survivability must be accomplished in a close link with the development of their other tactical features.

The basic tactical features of tanks are examined in the following sequence: firepower, protection, mobility.

FIREPOWER. The work of foreign specialists in this area is aimed at improving armament, ammunition, fire control systems, and conditions for observing from a tank, and they pursue the following objectives: an increase in range and accuracy of fire, an increase in potency of ammunition effect, and a reduction in the time for preparing the first and subsequent rounds.

The tank gun is considered to be the main tank weapon at the present time and in the near future. It is common knowledge that the rifled 105-mm gun is the most widespread on modern tanks with which the ground forces of capitalist country armies are outfitted. Up to the early 1980's only the British Chieftain tank had a 120-mm rifled gun, but then guns of increased caliber began to be used considerably more often. For example, the West German Leopard-2 tank is fitted with the 120-mm smoothbore gun of the Rheinmetall firm. The same gun, but modified according to American standards and designated the M256, has been installed on American M1A1 Abrams tanks since September 1985 in accordance with understandings between the United States and the FRG. In selecting the main weapon for a future tank being developed under the Leopard-3 program, the FRG also is looking toward this gun. Its installation on the Leopard-1 tank during modernization also is considered possible. It is also planned to use the domestically developed 120-mm smoothbore gun on the future French EPC tank.

The new Challenger tank in Great Britain also is outfitted with a 120-mm rifled gun. British specialists presently have developed a more powerful 120-mm rifled gun which they plan to install on the Challenger tank.

Increased caliber guns also are planned to be used in other capitalist countries. Thus, judging from foreign press reports, a gradual transition to 120-mm guns is occurring in world tank construction, with preference being

given to smoothbore models. But foreign specialists believe that reserves for improving the 105-mm guns have not yet been exhausted as of today, which will permit them to remain the main tank weapon for a considerable time yet.

An improvement in ammunition is regarded as a promising direction for improving tank firepower. Armor-piercing rounds comprise the basis of the tank's unit of fire. At the present time, finned armor-piercing, discarding-sabot composite shot has become most widespread and exists in tank units of fire of many world countries. As the western press notes, with a muzzle velocity of over 1,500 m/sec, such rounds are capable of penetrating a standard NATO three-layer target (a set of three armor plates 10, 25 and 60 mm thick separated from each other by 330 mm and tilted 60 degrees to the vertical) at a range of 3 km.

An increase in weight and weight-to-caliber ratio (the ratio of the length of the round's active portion to its diameter), a set of materials with necessary properties, and an improvement in ballistic characteristics are the basic directions for improving the effectiveness of these rounds. For example, the United States has developed the XM827 120-mm ammunition for the M1A1 tank with a finned composite shot made from depleted uranium and with a muzzle velocity of over 1,600 m/sec. American specialists are working to create the XM829 round with composite shot of improved design (ratio of core length to diameter is 20:1).

Other types of ammunition--shaped-charge, armor-piercing, high explosive, and multipurpose--also are being perfected. A certain amount of attention is being given to developing canister tank rounds for destroying enemy personnel.

Measures are being taken abroad to create new types of ammunition capable of destroying the armor of future tanks in connection with the appearance of new protective devices, particularly so-called "active armor," which reduces the effectiveness of shaped-charge projectiles. These new types of ammunition are being realized along the line of development of armor-piercing projectiles, including combination projectiles containing a shaped charge in the warhead and a core of solid, heavy material. The principle of action of such a projectile is that on approaching the tank the shaped charge is triggered by use of an influence fuze, and this causes the detonation of the explosive of the "active armor" components. The solid core following the shaped charge affects the main armor, assuring its penetration.

An improvement in conditions of observation from the tank and an improvement in the fire control system are considered abroad to be the most important reserves for improving tank firepower. Foreign specialists note that the weakest link even of the new tanks is the crew's inability to detect opposing targets quickly. Electro-optical devices such as night vision devices are used in the tanks along with optical devices to improve search capabilities with low illumination.

Active devices with an infrared illuminator and electro-optical converter were installed in tanks of the first postwar generation. The foreign press notes that their basic deficiency is the possibility of detection of the tanks on which they are installed by the enemy's infrared equipment. Later passive

devices were created operating on the amplification of natural nighttime illumination. Such devices ensure secrecy of use, but their first generation had an insufficient effective range, large size and high sensitivity to gating. Later models use single-stage amplifiers with microchannel amplifier-disks [shayba-usilitel] instead of multistage amplifiers, which permitted a reduction in size and allowed making them less sensitive to gating. The attempt at combining the advantages of both leads to the use of combination active-passive devices in tanks.

Night vision devices based on television technology and operating at a low level of illumination are finding increasingly wide use in recent years (in the French AMX-40 tank and the first lots of the Leopard-2 tanks). They represent a combination television transmission tube, electro-optical converter, receiving tube and power unit. The devices have high sensitivity and good resolution, and they are relatively nonsusceptible to gating (for example, from the round fired by the tank's own gun). In the opinion of foreign specialists, the advantages of television systems are the relatively free accommodation of a camera on the tank and possibility of the simultaneous connection of several monitor screens to all crew members but, due to the presence of television tubes, such systems are considerably more expensive than direct vision devices using electro-optical converters.

Great emphasis is being placed on the use of thermal-imaging devices abroad. Such devices are being installed in the new M1 Abrams, Leopard-2 and Challenger tanks, as well as in earlier production models in the course of their modernization. The thermal-imaging devices being used in tanks register the thermal emission of terrain and objects on it in the 8-14 micron wavelength band. This band has the most intensive energy emission from observed objects and at the same time a so-called atmospheric window of transparency. For this reason thermal-imaging devices permit distinguishing targets at great distances in the presence of fog and smoke, and they can be used not only at night, but also during the day. At the same time, as foreign specialists note, the design of thermal-imaging devices requires the use of advanced technologies, especially with respect to the highly sensitive detectors, which must be cooled by special systems to a temperature of around -200 degrees Centigrade, as well as with respect to high-precision scanning devices; this makes thermal-imaging devices very costly. A serious deficiency of these devices is the large size. For example, West German specialists deem it necessary to install a thermal-imaging device not only for the gunner, but also for the commander for the purpose of fire control redundancy, but this has not yet been accomplished due to the large size of contemporary standard American thermal-imaging units. In the opinion of foreign experts, this task appears solvable subsequently with the appearance of second generation thermal-imaging devices.

Laser rangefinders, which provide considerably higher measurement speed and accuracy in comparison with optical rangefinders, have become an inalienable part of modern fire control systems in foreign tanks. Their first generation, which appeared on tanks in the early 1970's, operated on ruby rods which created a pulse emission in the visible portion of the spectrum with a wavelength of 0.69 microns. The majority of laser rangefinders presently being used in tanks operate on neodymium-activated glass or yttrium-aluminum-garnet.

The primary deficiencies of such rangefinders are considered to be the danger of their emission to the eye (which causes certain difficulties in training personnel) and, most important, strong attenuation by fog, dust and smoke. Therefore a transition to third generation lasers (which do not have these deficiencies), in which carbon dioxide (CO_2) is the working body, is considered abroad as the near-term prospect. Since the emission wavelength of such lasers is 10.4 microns, detectors identical with television detectors operating in this same band can be used in the rangefinder photodetectors. All this makes it possible for compatible operation of the thermal-imaging device and laser rangefinder using one and the same design units.

Ballistic computers used for an objective accounting of the difference in current firing conditions from standard hold an important place in integrated fire control systems of modern tanks of capitalist countries. Mechanical ballistic computers gave way in the early 1970's to electronic computers, initially made with analog components. Then digital ballistic computers were created, installed in particular in the M1 Abrams and Leopard-2 tanks.

The basic directions for improving weapon stabilizers are an improvement in firing accuracy from the move, an improvement in reliability, and reduced fire danger of electrohydraulic laying drives during combat actions. In the latter instance a transition to electromechanical laying drives, which already are being used in particular in the British Challenger tank, is deemed advisable. Their installation also is possible in the M1 Abrams and Leopard-2 tanks in the course of their subsequent modernization.

The foreign press notes that firepower depends not only on firing accuracy and power of ammunition effects at the target, but also on the actual rate of fire. It presently is constrained by capabilities of the loader, who must load the gun with heavy, cumbersome rounds while functioning in a crowded fighting compartment. In addition, the need for giving him the conditions for working while standing dictates a great height of the turret and accordingly of the entire tank. One way to improve the rate of fire is to use an automatic loader (AZ).

Mechanized stowage can be accommodated in various places in a tank with a traditional turret design. Installation of the unit of fire below the turret race is considered safest from the standpoint of its vulnerability. It can be made in the form of a circular conveyor around the turret basket, a belt (chain) conveyor on or under the floor of the basket, or outside the turret basket in the front or rear portion of the hull. In this case, however, the path for delivering rounds from stowage to the gun turns out to be lengthy and the automatic loader itself relatively complex.

With respect to functioning conditions, western specialists prefer the automatic loader having its mechanized ammunition stowage accommodated in the turret recess. A variant of such an automatic loader has been proposed in particular for installation in the Leopard-2 tank in the course of its modernization (Fig. 1). In this case the path for delivering the round to the breech chamber is shortened and kinematics of the loading mechanism

simplified. But deficiencies of such an arrangement are considered to be the impossibility of loading the gun in an arbitrary position and the need for placing it on a loading line; the large area of horizontal projection of round stowage, which is difficult to protect against rounds hitting the tank from above; and the considerable change in moment of inertia of the turret as ammunition is expended. In studying the possibility and expediency of using the automatic loader in tanks, western specialists stress that the overall tank configuration must be considered in the planned installation of the automatic loader.

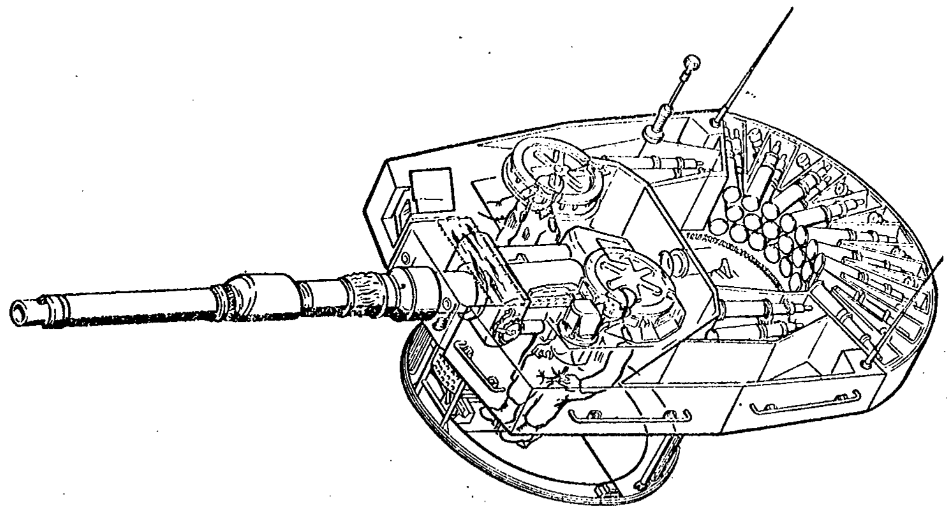


Fig. 1. Variant of automatic loader with accommodation of mechanized ammunition stowage in the turret recess of the Leopard-2 tank

Measures being accomplished abroad for the purpose of improving the PROTECTION of tanks are being conducted along two basic lines. The first includes design measures as well as techniques promoting a reduction in the effect of weapons against the tank and a reduction in the likelihood of shells of various types hitting it. The second direction provides for an improvement in the armor's resistance to the effect of rounds hitting it.

The first direction is being accomplished by increasing the tanks' own firepower, reducing dimensions (especially height and area of frontal projection), and increasing their battlefield mobility. More and more attention is being given in recent years to the use of camouflage means. It is emphasized that, like other models of weapons and military equipment, tanks must be provided with camouflage in the optical, thermal and radar bands. Special camouflage sets, camouflage paint, radio-absorbing and heat-insulating coatings, and improvised means are used to this end.

It is believed that smoke resources may have a certain effect on tank protection. Following the 1973 Arab-Israeli War NATO countries concentrated considerable efforts on creating new smoke-generating means. Since the mid-1970's multitube smoke grenade launchers have begun to be installed on tanks, using grenades with a smoke-producing composition based on red phosphorus. They allow creating a smoke screen up to 13 m high in a sector of

around 100 degrees in 2-3 seconds at a distance of 20-50 m from a tank. In addition to this capability, thermal smoke apparatus has begun to be used on American tanks.

The foreign press notes that modern smokes based on vapors of oil, hexachloroethane, and white and red phosphorus are opaque for optical systems which operate only in the visible and near-infrared regions of the spectrum. This includes optical devices for visual observation, guidance systems for modern PTUR [antitank guided missiles: ATGM's], laser (neodymium) rangefinders and target designators. For this reason work is under way abroad to create new means forming smoke screens impenetrable to electromagnetic emissions of a broader range. For example, the XM76 smoke grenade has been developed in the United States for the M1 Abrams tank. As American specialists have announced, it screens the tank in visible light and in the near, middle and far infrared bands. In addition, means are being created for forming thickening, "metallized" and other smokes which distort electromagnetic reflection and which are intended for countering low-frequency laser as well as radar equipment in the millimeter band.

Special devices which register a tank's irradiation are being developed for tanks in connection with the appearance of antitank weapons guided to the target by laser beam. Such devices will be installed on tanks to give the crew an opportunity to take timely protective measures, such as with the help of quick-acting camouflage means. Among the devices for increasing tank protection, foreign specialists consider it necessary to have identification friend or foe systems, which must be compatible with devices of similar purpose being used in aviation and other combat arms.

Those abroad are linking certain hopes for an improvement in tank protection against relatively "slow" ATGM's and antitank rockets with the creation of a so-called active protection. Its operating principle is that an approaching missile is detected by equipment installed on the tank and an effect is exerted on the missile (such as by firing a grenade toward it) to destroy it or at least sharply reduce its effectiveness. Active protection must contain three basic components--a system for detecting projectiles or missiles, means of destroying them, and a control unit (Fig. 2).

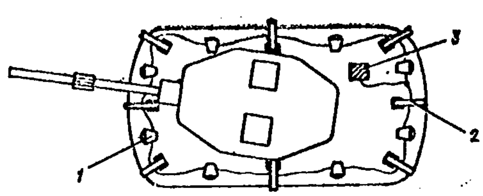


Fig. 2. Diagram of active tank protection:
1. Detection system sensors;
2. Weapon launchers;
3. Control unit (within the tank)

In the opinion of western specialists, ATGM's flying toward a tank can be detected by several methods, the most realistic of which is radar, but its use involves solving a number of problems. The primary problem consists of the

difficulty of picking out a usually weak signal reflected from the missile against the surrounding terrain background. A substantial deficiency of radar systems is their vulnerability to interference. In addition, active use of radar is a strong revealing sign which allows the enemy to detect the emitting tank at great range and subsequently destroy it using guided projectiles (with homing on the radar emission).

In this connection, it is considered possible to use electro-optical detection systems capable of discriminating thermal and other signs of a flying rocket to detect ATGM's and free-flight antitank rockets with sustainer motors. Israeli developers of active tank protection prefer such systems. At the same time, the specialists emphasize that radar is for now the only acceptable method for detecting ballistic projectiles, homing and free-falling warheads, bombs and other destructive submunitions flying toward a tank from above.

A detected missile can be destroyed by firing a grenade with high explosive or fragmentation warhead toward it, but it must be fired at a very specific moment in time so that the missile flying toward the tank enters the fragmentation field or the effect zone of the air shock wave. The task of determining the optimal moment of firing rests with the control unit.

Foreign specialists emphasize that all measures involving the aforementioned protection must be considered in a complex with the basic methods of assuring the tank's resistance to the effect of projectiles hitting it. Three of these are considered to be the most important and promising: creation and improvement of reliable armor protection, use of new methods of protection (particularly the use of explosive charges for these purposes) and development of a more rational configuration from the standpoint of protection.

About half of the tank weight on the average goes for armor protection of the main tanks. Armor material is distributed over the tank's surface so that frontal components of the hull and turret have the greatest thickness (with consideration of the tilt and turn of parts) within limits of a horizontal course angle of approximately 30 degrees inasmuch as the greatest likelihood of fire against a tank would come in this sector. At the present time the likelihood of the arrival of destructive elements from above has increased significantly in connection with the appearance of new antitank weapons (PTS). The tank sides and hull roof plate have a large area and so it is impossible to increase their protection by simply building up armor thickness with existing weight constraints. At the same time, foreign specialists emphasize that because of the growth in the number and, most important, in the effectiveness of traditional ground-based antitank weapons, it is not possible to weaken the protection of the frontal projection by removing a portion of armor material to reinforce the sides and hull roof plate. To the contrary, in their opinion it needs further improvement.

An increase in the armor's antiprojectile resistance is linked abroad with the development of new technology for the production of armor materials with improved properties, with the use of new metal and nonmetal materials along with armor plate, and with the creation and adoption of new designs of armor barriers, particularly combination armor (Fig. 3) in tank construction practice. The latter can provide more reliable protection both against shaped

charges and composite shot. The primary direction for its improvement is the choice of appropriate materials for armor and filler, a rational ratio of thicknesses of the layers making up the combinatin, and methods of connecting them. The use of explosive charges--components of so-called "active armor"--as a component element of combination armor is considered promising. Explosive charges can be contained in the cellular structure of armor or accommodated between armor plates. Such components were used in a mounted version on Israeli tanks during combat actions in Lebanon in the summer of 1982.

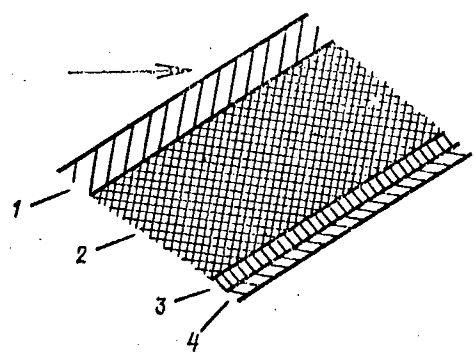


Fig. 3. Diagram of combination armor:
1. Front armor plate;
2. Filler;
3. Rear armor plate;
4. Lining protecting against fragments and penetrating radiation

The task of creating effective armor protection is closely linked with the need to rank tank components by importance in order above all to ensure reliable protection of the most important components which are vitally important for the tank. Therefore people abroad seek to use primary and auxiliary armor plating in designing tank hulls and turrets. They are trying to shift from primary to auxiliary armor plating those assemblies and units, damage to which does not lead to the tank's immediate disabling (air cleaners, ventilation filters, storage batteries and so on).

Serious attention is being given to improving tanks' resistance to the effect of various projectiles even in case their armor is penetrated. Steps are taken to this end to localize damage (hermetic bulkheads are installed in the tank's internal space to separate ammunition, fuel and other equipment components from the manned compartment), and fire and explosion suppression systems are used. For example, automatic, quick-acting firefighting equipment systems are being installed in modern tanks, such as the "Gravener" (Great Britain and the FRG) and "Spectronix" (Israel), which provide for detection and suppression of combustion in 80-150 milliseconds, i.e., before it develops into a fire.

The task of improving MOBILITY indicators, and above all the dynamic properties of vehicles and their average rates of march, retains its current nature in foreign tank construction. It is being solved by improving existing engines, transmissions, and tracks and suspension elements and creating new ones.

In connection with the fact that tank mobility is greatly affected by engine power, capitalist countries are continuing research to create models having a large power reserve. Meanwhile, considering the constraints which actually are in effect, foreign specialists believe that the requirement for power-to-weight ratio will be preserved at a level of 25-30 hp/tons for future tanks with rigid size-weight limits on the engine-transmission unit. This can be accomplished using diesel or gas-turbine (GTD) engines.

Advantages of gas-turbine engines are considered to be the possibility of obtaining greater power with the same size as a diesel engine, lesser weight, relative simplicity of design, and a more favorable torque characteristic. But in comparison with diesels of equal power, modern gas-turbine engines expend considerably more fuel (by 50-80 percent). In addition, they consume approximately three times more air, which generates higher demands on its cleaning and consequently additional design expenditures for volume and weight. For this reason work presently is under way on both types of engines. It is emphasized that the possibilities for improving diesel engines have been far from exhausted as yet. This is attested in particular by the experience of West German designers.

Research also is being conducted abroad to create an adiabatic engine in which the heat exchange between combustion chambers and the surrounding medium is sharply reduced through the wide use of special materials (particularly ceramics). Such an engine, developed for example by the American firm of Cummings, is said to withstand high temperatures and have the least specific fuel consumption of all engines. It is planned to begin its series production in the late 1990's. Work also continues on engines of other types--two-cycle diesels, rotary engines and others.

Tank transmissions of armies of capitalist states are made chiefly as hydromechanical transmissions, with not only hydrodynamic, but also hydrostatic transmissions becoming more and more widespread. The latter are used basically in the auxiliary drive of the transmission and steering mechanisms, providing a variable-speed radius of turn. Hydrodynamic speed reducers which increase the effectiveness of braking and dynamic qualities of the tank as a whole are becoming an important component of hydromechanical transmissions.

The suspension of modern tanks is basically torsion, using hydraulic (friction in the Leopard-2 tank) damping devices. An improvement in the technology of producing torsion bars permitted sharply increasing their permissible load and obtaining large dynamic and full running [polnyye khody] of road wheels. For example, the full running of the road wheels of the Leopard-2 tank is 520 mm, which gives it good smoothness of movement when moving over broken terrain.

A hydropneumatic suspension (GPP) is being considered as promising and is already being used in the STRV-103B (Sweden), "74" (Japan) and Challenger (UK) tanks. Advantages of the hydropneumatic suspension are the better conditions it provides (from the standpoint of vibration) for the crew and weapons. In addition, the hydropneumatic suspension assemblies are installed on the

outside and do not take up space within the hull. Such accommodation makes them easier to replace in case of combat damage.

Work is being done to improve track drive components. The basic directions of such work include creating an automatic track tension adjustment system, reducing the likelihood of tracks being thrown during movement, increasing the service life of tracks and driving wheels, and making servicing easier.

CONFIGURATION. One direction in tank design development with which people connect possibilities of limiting height and even making a certain reduction in tank weight is the development of new and more rational configuration arrangements. Modern tanks are characterized by the so-called classic configuration in which the main armament is accommodated in a rotating turret, the power plant and transmission in the rear part of the vehicle, and the crew separately: the tank commander, gunner and loader accommodated in the turret and the driver-mechanic in the driving compartment (in the forward part of the hull). Along with advantages which determine its widespread nature, such an arrangement also has inherent deficiencies: the vehicle's high silhouette (there must be provisions for necessary gun angles of elevation and depression and the possibility for the loader to work standing up), large turret size, and difficulties of creating reliable protection, dictated to a considerable extent by the crew separation.

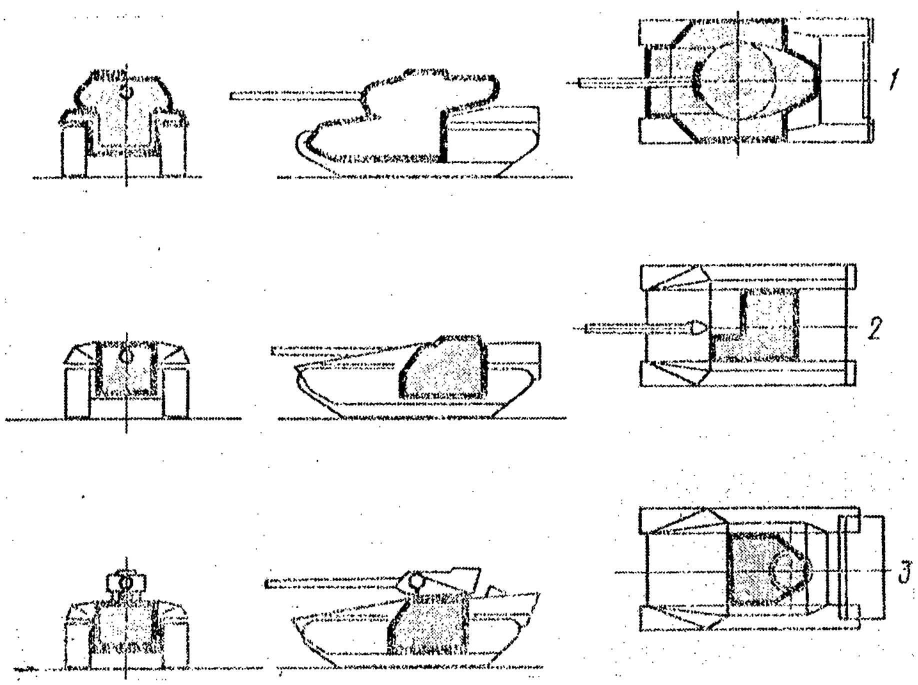


Fig. 4. Layout and size of manned compartments in various tank configuration arrangements:
1. Traditional;
2. Casement installation of weapon in hull;
3. Weapon removed

In seeking new configuration solutions, foreign designers are attempting to use all possible methods to reduce the tank's armored volume, especially its manned compartments (fighting and driving), inasmuch as these are areas which must be protected with the thickest and heaviest armor. Therefore configurations of turretless tanks accommodating the main weapon in the hull or removing it from the armored space are being considered as an alternative to the traditional configuration. Fig. 4 shows that such configurations can provide for a decrease in the tank's armored volume and as a result to a decrease in its silhouette and weight, but each of them have serious inherent deficiencies.

For example, with casement installation of one or two guns in the hull, serious difficulties arise in firing from the move and movement and fire control systems become more complicated, along with the difficulty of facilitating the process of loading automation and localization of combat damage.

The primary advantages of tank configurations with weapon installed on a rotating carriage on the hull roof or on an extensible elevating carriage in a special recess or in a low-silhouette turret are considered to be the compact accommodation of the crew in the hull, because of which its protection is improved and fighting compartment volume (and consequently the volume of the entire vehicle) is decreased, and the absence of a cumbersome turret. All this leads to a reduction in likelihood of such a tank being hit. At the same time, such a weapon installation imposes very serious constraints such as the absence of manual loading, difficulties of remedying gun malfunctions and stoppages during firing, the need to use complicated systems to provide all-around observation, a deterioration in protection of weapon assemblies and others.

Western specialists note that there is still room to improve the classic configuration. For example, a reduction in fighting compartment volume can be achieved in particular by using an automatic loader with a simultaneous reduction in crew size. The height of the turret and of the entire tank can be reduced substantially by a special hatch in the turret roof allowing the breech end of the gun to exit at large depression angles. Variants of installation of a low-silhouette turret on a tank are being developed under the modernization program for the American M1 Abrams tank, for example. A reduction in the size of other compartments of tanks of traditional configuration also is possible by using more compact assemblies with their rational placement.

Thus intensive work is being done in foreign tank construction for further development of combat and technical characteristics of the main tanks. Research and design explorations are being carried out both along the path of improving traditional configuration and in the direction of using fundamentally new arrangements, realization of which is possible only on the basis of modern technology. In both cases it is planned to use automatic loaders, thermal-imaging and television observation systems, more advanced (including remotely controlled) weapon control systems, new ammunition, special protection systems, new components providing necessary mobility and so on. In the opinion of foreign specialists, adoption of S&T achievements in

tank construction will permit tanks to retain the role of one of the main weapons in the armament system of ground forces even in the future.

6904
CSO: 1801/246

THE FIGHTER-BOMBER IN COMBAT

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 31-37

[Part One of article by Col V. Kirillov, candidate of military sciences; passages rendered in all capital letters printed in boldface in source]

[Text] During broad militaristic preparations imperialist circles of the United States and other NATO bloc member countries have been giving increased attention to the development of tactical aviation, particularly its main striking force, fighter-bombers, with consideration of the experience of air force employment in various wars and armed conflicts, the experience of their day-to-day combat training, as well as results of flight tests and experiments.

As the foreign press emphasizes, the fighter-bomber designation is given to tactical combat aircraft (tactical fighters) capable of hitting ground as well as airborne targets. The first subsonic jet aircraft for that purpose operated in the U.S. Air Force during the aggressive Korean War. In subsequent local wars unleashed by American imperialists in Indochina and by Israeli extremists in the Near East they were replaced by supersonic all-weather aircraft outfitted with guided weapons. The main factors determining fighter-bomber combat capabilities showed up under combat conditions; western military experts include among them autonomy, survivability, multifunctional nature, and destructive power.

AUTONOMY is the capability of carrying out a combat assignment independently. In the views of foreign specialists, the fighter-bomber differs from the attack aircraft which operates on the forward edge directed from a control post, or from a fighter controlled from a ground (airborne) command post by the fact that its typical mission involves the delivery of strikes against targets located at a relatively great depth, where the aircraft leaves the limits of the information field created by radars from friendly territory. In flying a great distance at low altitude, it usually leaves the short-range navigation system coverage and loses radio contact with the command post.

The foreign press notes that crews of American and Israeli fighter-bombers which have flown autonomous piratic raids against various targets located on the territories of countries of Indochina and Arab states of the Near East respectively experienced considerable difficulties both in navigation and

weapon employment as well as in carrying out tactical concepts. In the opinion of foreign specialists, this occurred for several reasons.

First of all, not receiving data on the air situation from external sources, the crew was forced to collect the data itself. Its information field was small, however, which led to the appearance of extremely undesirable situations. Enemy fighters would take up an attack position outside of the crew's visual range and before the crew entered the zone where on-board search equipment would detect enemy aircraft, and so there was not enough time to eliminate the threat. For example, at the beginning of aggression against the DRV American F-105 fighter-bombers suffered telling losses from the fire of Vietnamese subsonic fighters which closed to within range of cannon fire undetected.

Secondly, not only was there no contact with command posts, but an exchange of information between crews of the strike group and covering fighters also was hampered. In an attempt to eliminate the threat of attack from distant lines, covering fighters would go far ahead to meet enemy fighters. In this case visual contact and mutual fire support were disrupted. Gaps formed in the mixed combat formation which the Vietnamese pilots skillfully used for penetrating to the strike group.

Thirdly, after the flight became autonomous, control shifted to the commander of the mixed group, who was additionally performing pilot duties. He had to make decisions in each succeeding phase of the flight: when entering enemy territory, when overcoming air defense in the vicinity of strike objectives, and on the return route. Development of decisions could be based only on stable observation of the entire combat formation and on the monitoring of command execution, but these conditions essentially were not fulfilled since the commander could observe only a portion of the aircraft in the group. As a result, breakdowns in control were added to the imprecise coordination, the consequences being chaotic displacements of individual aircraft (or groups) which disrupted the flight plan and the all-around defense system.

Fourthly, in the absence of target designation from control posts (points), pilots would search for a given target and identify it independently. The productivity of this process was sharply degraded in a flight at low altitude and high speed. The so-called "tunnel effect" came into play, where the attention of a pilot who is trying to maintain given flight conditions is focused in a relatively narrow sector directed ahead and below to a limited distance. If the target did not fall within this sector the pilot was forced to make another pass, i.e., be under fire of the objective's air defense for a more lengthy time.

Fifthly, the absence of informative and command data in a flight over enemy territory affected the morale of a pilot who was constantly expecting an attack but was not receiving data on the time and direction of the threat. Under these conditions there was a loss of attention acuteness and reaction speed necessary in aircraft navigation and in executing complicated elements of the flight and combat employment of weapons.

U.S. military specialists connected the reduction in loads and difficulties of an autonomous flight above all with the need to extend the information field to the combat zone. For this reason EC-121 and E-2A long-range radar detection (AWACS) aircraft were included among American aviation operating during the aggression in Indochina. They were outfitted with surveillance radars and special gear for processing airborne situation data (the detection range of airborne targets was 300-400 km). Special equipment and plan-position indicators allowed their crews to monitor the flight of fighter-bombers to the full radius of action. During American air raids against DRV objectives the AWACS aircraft would occupy a duty station over the Gulf of Tonkin and cover the entire bombing area with their radar fields. At the end of the war up to 90 percent of all U.S. aircraft sorties were flown under their supervision.

Air operating tactics employing the AWACS aircraft developed in Vietnam were used rather extensively by the Israeli Air Force in the Near East. The crews of AWACS aircraft would accomplish the following missions: reconnaissance of the air space, warning to groups of attack aircraft about the appearance of enemy fighters, control of movement and of combat formations of mixed groups, assistance to them in approaching given targets, and direction of rescue operations.

In evaluating the capabilities of such a command and control system, foreign military specialists note that its use was facilitated by the geographic conditions of areas in which combat actions were waged. They emphasized that the AWACS aircraft could approach fighter-bomber combat zones not only from the direction of the front line (the land border), but also from the sea, i.e., they could patrol near the coasts of the DRV and Lebanon in neutral waters. The patrol zones of AWACS aircraft thus were beyond the killing zones of air defense weapons and as a result complete security of their flight was retained. In the opinion of foreign experts, however, that possibility is almost precluded in many TVD's [theaters of military operations], and especially European ones, since patrol zones will have to be moved into the interior of friendly territory under protection of air defense weapons. In addition, based on provisions of the "deep strike" concept adopted by NATO, fighter-bombers often will deliver strikes against enemy second echelons and reserves located far beyond the limits of radar fields even of the most advanced on-board radars of AWACS aircraft, and so their crews again will encounter the problem of autonomous flight.

NATO military specialists consider the most acute issues in this problem to be assurance of an independent search and identification of the target, aiming, and the attack. Various technical means have begun to be developed and used to solve them. In particular, the American F-111 and F-4 Phantom aircraft operating as fighter-bombers began to be outfitted in recent years with the Pave Tack combination aiming system, the basis of which is infrared and laser equipment.

According to a report in AVIATION WEEK AND SPACE TECHNOLOGY, during an experimental flight (altitude 210 m, speed 990 km/hr), the operator of an F-111F aircraft used on-board radar to detect the target location (a range) at a distance of 130 km. Then he lined up the radar mark with the signal

reflected from the target, and as a result the line of sight of the IR subsystem was automatically directed to the target. After the target image appeared on the IR equipment screen and after the operator had identified it, he shifted to manual tracking in an attempt to hold the aiming mark on the image of the attack target. But he succeeded in accomplishing accurate aiming using the laser subsystem only on the fourth pass (the bomb fell 6 m from the target).

One flight (altitude 300 m, speed 850 km/hr) tested the system's capability in a simulated attack on an electric power station. The operator performed radar lock-on of the target at a distance of 24 km and identification at 16 km, and he stabilized the aiming mark on the target at a range of 14 km. Further tracking was done automatically. This allowed delivering an accurate "strike" by a UAB [guided aerial bomb] with a laser homing system, as well as by bombs with a retarding device. On the next pass "bombing" was accomplished from a dive. A laser beam began illuminating the target on command from the on-board computer, which also issued the signal for execution of a 3-g maneuver in which the laser beam was held on the target for 8-10 seconds after the beginning of the dive.

As noted in the foreign military press, experimental flights demonstrated that technical advancements had increased the independent search zone, but results continued to depend largely on the experience and proficiency of the aircraft crew. Stable skills were required for working with the system, and they were acquired only through lengthy, persistent training. In addition, automatic performance had to be combined with an evaluation of incoming data and selection of the most advisable form of maneuver and attack. This also relates to other search and aiming systems.

U.S. Air Force specialists consider the problem which is second in complexity to be that of assuring requisite accuracy of fighter-bomber navigation along the flight route to the target. The rather frequent instances of loss of orientation during combat actions by American aviation in Indochina pointed out gaps in flight personnel training and the imperfection of the aircraft navigation equipment. Urgent steps therefore were taken to restore skills lost by the crews in monitoring the flight route from ground reference points. Routes were "tied in" to rivers, highways, railroads and seacoast easily picked out from the air. Leaders often would be appointed whose role was performed by reconnaissance aircraft with special navigation equipment and experienced navigators aboard. They would "lead" fighter-bomber groups to limits of the killing zone of target air defense and give them target designation.

With consideration of the above, the United States and other NATO countries began to create various pieces of navigation equipment for tactical aviation and above all for fighter-bombers which allowed them to accomplish various missions more effectively. As a result modern combat aircraft are outfitted with sophisticated navigation systems and numerous sensors, computers and other technical equipment promoting the effective accomplishment of autonomous flights to the full radius of action. In the opinion of western experts, however, their characteristics still do not fully satisfy the demands for assuring an autonomous flight and so despite considerable expenses it is

necessary to continue work in this direction. They justify the rightfulness of this work aimed at assuring greater independence in tactical strike aircraft actions by saying that it is connected with attainment of a number of serious tactical advantages: it becomes possible to reject the assignment of combat support resources of auxiliary forces not participating in delivering the strike; there is no more need for using a mixed combat formation which does not have sufficient maneuverability and is difficult to control by a single commander; and finally, prospects appear for selecting rational tactics and especially for changing them rapidly with a sharp change in the situation.

Foreign specialists consider the fighter-bomber's insufficient survivability and requirement for comprehensive protection to be one other essential obstacle to solving the problem of fighter-bomber autonomy.

SURVIVABILITY (level of losses) is considered by some western specialists as the ratio of the number of aircraft shot down to the total number of aircraft-sorties flown. It depends both on reliability of equipment and capabilities of defense in combat, as well as on the flight personnel's professional training. The level of losses of U.S. and Israeli air force fighter-bombers in local wars was considerably higher than the corresponding indicator for American aviation in World War II. The latter was 0.9 percent, i.e., there were 9 aircraft shot down for every 1,000 aircraft-sorties, while in the armed aggression of the United States in Indochina and of Israel in the Near East it reached two percent for fighter-bombers (20 aircraft shot down for 1,000 aircraft-sorties).

Foreign military specialists explain this fact above all by a strengthening of air defense--creation of more advanced means of combating aircraft. They note that the air defense of the Democratic Republic of Vietnam and the Arab countries which were subjected to aggression was organized according to the contemporary model and outfitted with powerful means of combating aircraft. But they also do not exclude the influence of reasons involving the imperfection of aviation equipment and tactics. Foreign military experts include the following among such reasons.

The FIRST reason is the vulnerability of aircraft structures, i.e., their insufficient survivability, characterized by the probability of a return to base after performance of a combat mission.

According to the foreign press, incorrect assessment of the kinds of possible threats in developing aircraft in the 1960's led to the fact that their qualities such as survivability were not recognized as primary. It was believed that even a protected aircraft would be incapable of withstanding the fire of air defense weapons (a missile hit on it was linked with inevitable loss). Therefore primary attention was placed on aircraft flying characteristics, especially flight speed and altitude. Any device or system not contributing to their improvement was perceived with deep mistrust. But combat experience showed the insolvency of such views and forced work to be done to improve aircraft survivability. For example, to solve this problem the U.S. Air Force spent some $124 million in the first two years of the war in modifying tactical fighters making raids on the DRV. The bulk of this sum was spent on the F-105 fighter-bombers, the vulnerability of which proved

higher than expected. The hydraulic and fuel systems as well as components of the flight control system were admitted to be especially unreliable under conditions of air defense opposition. Therefore special protectors were installed on aircraft fuel tanks and the most vulnerable places were armored right during combat actions, but there was no success in protecting the control rods passing through the entire fuselage to the tail unit. In this connection the American press noted that it would have been considerably simpler to provide for the aircraft's necessary survivability during the course of its development than during subsequent modernization under field conditions.

The SECOND reason was the weak individual protection of fighter-bombers. Analyzing the course of combat actions in local wars, AVIATION WEEK AND SPACE TECHNOLOGY wrote that the enemy's use of antiaircraft guided missiles with passive homing systems placed rigid demands on aircraft protection. The acuteness of this problem was dictated by the fact that it was difficult for crews of such aircraft to obtain warning information about an attack, and active threat suppression systems were very costly and insufficiently reliable. Therefore the need arose for a comprehensive approach to its solution with a detailed examination of technical and tactical issues. But at that time tactics was based on a very limited number of techniques, the principal one being an altitude maneuver with the aircraft's exit beyond the range of short-range ZRK [SAM systems] and with use of active electronic countermeasures against long-range SAM systems, which was not always effective and so certain technical improvements in the aircraft were required.

Based on this, the following were installed in U.S. Air Force fighter-bombers in the course of the war in Vietnam: equipment warning of the launch of surface-to-air missiles, suspended pods with active jammers, antiradar decoys and IR decoys (the latter were used in almost every pass against a target regardless of whether or not enemy low-altitude air defense systems were offering resistance). Pods with this equipment held a firm place on the aircraft. American specialists equated them in importance to weapon systems for fire suppression of air defense weapons.

As the western press notes, these measures initially had a positive effect on survivability, but in the course of the war the combat capabilities of the opposing side's air defense weapons also increased, and so the level of American air losses did not undergo significant changes--the problems of individual aircraft protection remained and required resolution.

The THIRD reason was the need to fly at low and medium altitudes at subsonic speeds. The F-105 and F-4 fighter-bombers which took an active part in local wars had a maximum speed of M>2, but those conditions were reached when flying at high altitude and with a limited load on external attachment. In addition, under combat conditions they had to fly at low and medium altitudes assuring acceptable bombing accuracy.

The standard combat load of such aircraft was considered to be 6-8 340 kg bombs accommodated on external attachment stations, and so aircraft drag sharply increased, which reduced flight speed and degraded maneuverability. The American journal ORDNANCE wrote: "In penetrating air defense the aircraft

were especially vulnerable when they were flying with a bomb load and could not develop a speed of more than 890 km/hr. Enemy interceptors vectored from the ground would close from the rear hemisphere at a speed sometimes exceeding the speed of sound and move unhindered to the missile attack line. Although pilots of the escorting groups knew about this tactic, it was difficult to oppose it with anything."

The FOURTH reason was that fighter-bombers were forced to exclude not only high altitudes, but also medium altitudes from the tactics employed in the war because the opposing side's air defense system was equipped with SAM systems which had a killing zone covering these altitudes. In addition, inasmuch as the radar detection range of the aircraft reduced as flight altitude decreased, American aviation extensively used low and extremely low altitudes in penetrating air defense. But in evading the threat of being hit by surface-to-air missiles, the aircraft in descending would come into the zone of effective fire of small-caliber AAA. As a result this obsolete weapon (in the opinion of western military experts) accounted for the bulk of American fighter-bomber losses.

It is noted here that the location of antiaircraft batteries (especially small caliber batteries) was difficult to detect by electronic intelligence, jamming was absolutely ineffective against them, and the launch of antiradar missiles was precluded.

The FIFTH reason for low survivability of fighter-bombers in local wars was the great crew fatigue.

The long duration of a combat flight (the time for mission accomplishment by F-105 crews in Vietnam reached 2.5 hours counting aerial refueling of the aircraft) with a variable profile and execution of evasive maneuvers demanded maximum attention and expenditure of physical energy. Therefore on the leg of the route in which it was necessary to perform complex functions of target search and attack (under conditions of intensive air defense opposition), the pilot's reaction already was slowed and his responses to a sudden threat on the enemy's part were delayed.

Modern tactical aircraft are being built and modernized and new advanced tactical attack aircraft are being developed based on the above. For example, a control system with treble redundancy has been installed in the Tornado aircraft to improve survivability. It is to provide not only the requisite reliability, but also acceptable stability and fast reaction of control surfaces to facilitate piloting an aircraft with a full combat load. In addition, its fuel tanks and the most vulnerable assemblies of other systems are protected. Navigation gear can operate in four regimes, the main one being an integrated regime using inertial and course subsystems, Doppler radar and airborne data computer. The latter is linked with a digital computer and can operate with one of the indicated subsystems as well as independently support aircraft navigation in case they are disabled.

In addition to an improvement in reliability of design of the aircraft and its basic systems, foreign military specialists consider other directions for assuring survivability to be outfitting with weapons which would be employed

in a stand-off mode; use of an integrated flight and weapon control system; creation of conformal weapon suspension systems; and a reduction in radar cross-section.

Guided aerial bombs and missiles with various guidance systems are becoming widespread abroad for the purpose of ensuring safety of an attack against targets in a stand-off mode. But to use them on fighter-bombers it is necessary to have appropriate aiming equipment and gear for guiding weapons to the target. It is not always possible to have them aboard one aircraft because of the presence of a rather large amount of such equipment and gear operating in various bands of the electromagnetic spectrum. The U.S. Air Force and air forces of other NATO member countries consider one solution to this problem to be use of suspended pods fitted with various systems for search, aiming and weapon guidance to the target. Pods with appropriate equipment are suspended on the aircraft depending on the weapon to be used. In the opinion of western experts, this permits a substantial improvement in the effectiveness of combat employment of tactical strike aviation, and fighter-bombers above all.

The heavy load on tactical fighter crews, especially in flight phases such as target search, aiming and attack, led to the need to equip aircraft with integrated flight and weapon control systems which make it possible to reduce the load on pilots.

One such system was tested in the American F-15B aircraft. The foreign press noted that results of a preliminary semifull-scale modeling in a simulated combat situation showed that it can provide for an increase in likelihood of aircraft survivability by severalfold, and its primary advantage is the possibility of making an attack against a ground target with automatic aiming and simultaneous execution of an evasive maneuver.

The aircraft entered the calculated zone of intensive antiaircraft fire during the tests with an abrupt deviation of flight trajectory (with the execution of such figures as a half-loop and half-roll), then it would be placed in a dive on the return course. It was not necessary to hold the target in the crosshairs after lock-on, i.e., move in a straight line and present a target to AAA. The closing to within permissible firing range was accomplished in a skidding turn. The F-15B attacked targets three times faster than done by an aircraft not equipped with the flight and weapon control system.

The British journal FLIGHT wrote with respect to the question of drag when flying with a combat load on external attachment points that bomb racks on some fighter-bombers had been developed 20 years ago and were obsolete. Suspension variants presently are being tested on pylons with multilock holders providing for a smooth interface of weapon lines with the aircraft airframe and thus greater preservation of maneuver and speed qualities necesary for aircraft survival.

To solve this problem on the Tornado aircraft, the principal weapons are placed right up against the fuselage surface. The United States tested a special device on the F-4B aircraft for accommodating twelve 500 pound aerial bombs (four rows of three bombs each) with positive release. As the western

press reported, the aircraft's overall drag with this attachment version dropped considerably (in comparison with the usual), and maximum flight speed increased from M=1.1 to M=1.8. Bomb release was safe within the limits of combat flight conditions. The aircraft's maneuver characteristics essentially did not deteriorate in executing all kinds of evasive and other advanced maneuvers in attacking ground targets. According to the foreign press, searches for schemes and methods of optimal weapon attachment continue at the present time. One of them is the positioning of weapons (in aerodynamic cases) on the upper fuselage with upward firing (see diagram). Such a system is especially needed in delivering attacks from extremely low altitude.

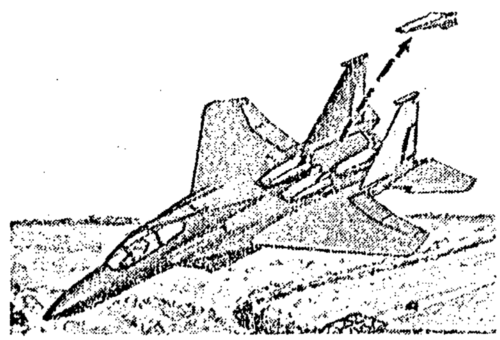


Diagram of upper fuselage weapon positioning (in aerodynamic cases) with upward firing

Up until recently positive weapon release devices were used only to assure safety of release when attacking a target. But the need for reducing radar cross-section in order to reduce aircraft detection range by enemy air defense system radars presented additional requirements not only for the positioning of weapons, but also for methods of their release (launch). Based on this, the American firm of Northrop developed a system of "air cylinder catapults" which uses special recesses for accommodating weapons and "conformal" air cylinders. According to statements of the firm's specialists, rapid filling of the cylinder shoves out (releases) the weapon, and the cylinder's assumption of a shape conforming with the aircraft's external lines is to preclude an increase both in drag and radar cross-section (the latter could occur from the effect of recesses which form after release of the payload).

Foreign military specialists believe that the basic directions for resolving the problem of reducing aircraft radar cross-section are the following: improvement in airframe configuration and use of materials which do not reflect electromagnetic energy and coatings which absorb it, i.e., those which are the basis of the American "Stealth"* technology.

Results of a simulation performed by western experts of the influence of flight altitude and speed and the change in radar cross-section on fighter-bomber survivability showed that an aircraft with radar cross-section

*For more detail on the "Stealth" program see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1985, pp 49-51--Ed.

reduced tenfold flying at high altitude and supersonic speed within limits of the enemy radar field had a fourfold increase in survivability.

(To be continued.)

6904
CSO: 1801/246

U.S. GUIDED BOMBS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 38-43

[Article by Col R. Sedykh, candidate of technical sciences; passages rendered in all capital letters printed in boldface in source]

[Text] In pursuit of military-technical superiority over the USSR, the Pentagon is devoting fixed attention to improvements in aviation weapons designed for delivering strikes against ground targets. Primary emphasis in their development is being placed on development of guided aerial weapons capable of hitting targets with the first attack of the platform aircraft.

In the opinion of American military specialists, one of the most optimal types of precision aviation weapons is guided bombs (UAB). They summarize in themselves, as it were, the basic advantages of conventional bombs (because of the powerful warhead) and air-to-surface guided missiles (because of high precision in hitting the target). But the characteristic gliding feature of the guided bombs permits their use without airborne platforms entering the zone of the enemy's target air defense system and thus substantially improves combat effectiveness.

The ratio of warhead weight to total weight is regarded as an important characteristic of each weapon. For example, this ratio is close to 1 for conventional unguided bombs, it is 0.2-0.5 for air-launched air-to-surface guided missiles (UR), and approximately 0.7-0.9 for guided bombs. This means that with total weight and range of employment being equal the guided bomb can deliver a warhead almost twice as large as the guided missile to the target.

The absence of a motor and fuel for it and the simpler manufacturing technology make guided bombs less costly compared with the guided missile. But the presence of a control and guidance system, often standardized with similar guided missile systems, gives guided bombs all features of a precision aviation weapon. As shown by the experience of combat employment of guided bombs in the aggressive U.S. war in Indochina, the expenditure of these weapons for destroying a target was almost 50-100 times less than for conventional unguided bombs. According to calculations by American experts, with consideration of the cost of aircraft-sorties and probability of airborne platforms being hit by weapons of the enemy target's air defense, the cost of destroying a target using guided bombs is lower than the cost of destroying a

target with conventional bombs. Herein lies one of the basic reasons of the fixed attention given abroad to creation of new guided bombs and improvement of existing models. Information is given below on the dynamics of development of guided bombs in the United States, and selected problems of their tactical employment are covered.

At the present time the U.S. Air Force and Naval Aviation have guided bombs of 500, 1,000, 2,000 and 3,000 pounds with television, semiactive laser, and television-command (thermal-imaging command) guidance to the target. They are equipped with warheads of high explosive, fragmentation-high explosive, penetrating and cluster types* (basic characteristics of U.S. guided bombs are given in the table).

Basic Specifications of U.S. Guided Bombs

Name & Nomenclature of Guided Bomb, Year Operational	Size, Pounds / Overall Weight, kg	Warhead: Weight, kg (explosive weight, kg) / Type (based on which bomb)	Maximum Flight Range, km / Altitude Employed, meters	Guidance System / Hit Accuracy (CEP), meters	Bomb Size cm: length x case dia / Wingspan	Airborne Platforms
1	2	3	4	5	6	7
Special-Design Guided Bombs						
Walleye I Мк1 мод.0, 1966	1000 / 500	385 (182) / HE	25 / 2000—9000	TV / 5	344×38 / 114	A-4, A-6, A-7, F-4, F-111
Walleye II Мк5 мод.4, 1973	2000 / 1100	907 (430) / HE	40 / Up to 9000	TV-Command / 5	404×45 / 130	A-4, A-6, A-7, F-4, F-111
Walleye II Мк13 мод.0, 1975	2000 / 1100	907 (430) / HE	65 / •	TV-Command / 5	404×45 / 173	A-4, A-7, F-4, F-111
GBU-17, 1982	• / •	• (.) / HSM concrete piercing	• / •	Laser / About 10	360×160 / 82	F-4
Guided Bombs Created on Basis of Standard HE Bombs						
GBU-12, 1971	500 / 285	227 (87) / Мк82	• / •	Laser / About 10	330×28 / 100	A-7, F-4
GBU-12*, 1978	500 / 285	227 (87) / Мк82	About 10 / 200—6000	Improved laser / 10	330×28 / 130	A-10, F-4, F-5, F-14, F-15
GBU-22, 1984	500 / •	227 (87) / Мк82	• / Low & extremely low	Improved laser / •	×28 / •	F-4, F-16, F-111
GBU-16, 1976	1000 / 480	453 (215) / Мк83	• / •	Laser / About 10	350×36 / 160	A-4, A-6, A-7, F-4, F-14
GBU-23, 1983	1000 / 500	453 (215) / Мк83	• / Low & extremely low	Improved laser / •	365×36 / •	A-4, A-6, A-7, F-18
AGM-123A, 1983	1000 / 582 with solid fuel rckt motor	453 (215) / Мк83	• / Low & extremely low	Improved laser / •	430×36 / 160	A-4, A-6, A-7, F-18
GBU-8, 1969	2000 / 1100	907 (430) / Мк84	20 / Up to 900	TV / 5	378×46 / 110	A-7, A-10, F-4
GBU-10, 1971	2000 / 1100	907 (430) / Мк84	12 / 5500—6500	Laser / •	415×46 / 137	A-6, A-7, A-10, F-4, F-14
GBU-10*, 1978	2000 / 1100	907 (430) / Мк84	• / 150—6000	Improved laser / About 10	415×46 / 167	A-6, A-7, A-10, F-4, F-5, F-14, F-15, F-16, F-111

[Cont'd on next page]

*The foreign press often includes guided bombs with cluster warheads in a separate class of weapons--guided clusters--Ed.

1	2	3	4	5	6	7
GBU-24, 1985	2000 / •	907 (430) / Mk84	• / •	Improved laser / •	• / •	F-4 F-111
GBU-8, 1969	2000 / 1645	1300 (298) / M118	20 / •	TV / •	400×61 / 150	F-4
GBU-11, 1971	2000 / 1400	1360 (896) / M118	12 / 5000—6000	Laser / •	418×61 / 170	F-4
Modular Design Guided Bombs						
GBU-15, 1980	2000 / 1140	907 (430) / Mk84, HSM concrete piercing, FAE	50 / 600—13 000	TV- and thermal imaging -command, laser / 5	390×46 / 150	F-4, F-111, B-52
GBU-20, 1984	2000 / 1300	907 (430) / CBU-54 cluster, HSM concrete piercing, FAE	70 / Up to 13 000	TV- and thermal imaging -command, difference-ranging, satellite / •	400×46 / 240	B-52
AGM-130, under development	2000 / •	907 (430) / Mk84	37 / Extremely low	TV- and thermal imaging -command, laser / •	• / •	F-4, F-111, B-52

*Second generation guided bombs.

The foreign press notes that the development of American guided bombs followed the line of creating weapons of special design based on organic high explosive bombs and modular design.

Western specialists include among guided bombs OF SPECIAL DESIGN bombs such as the Walleye. In its development process, controlled flight processes were worked out for the first time, principles of precision guidance were implemented, communications lines from the aircraft to guided bombs were adjusted, and appropriate gear was created. The first TV controlled Walleye-I Mk 1 Mod 0 bomb was created in 1966. It is equipped with a wing, aerodynamic control surfaces and gear for controlling them, fragmentation-high explosive warhead and TV homing head, which permits hitting the target with an accuracy almost two orders of magnitude better than that of a free-fall bomb. The TV homing head provides for the bomb's guidance to optically contrasting objects, with the operator performing their selection and identification. After lock-on and stable tracking of the target by the homing head, the bomb is released and independently guided to the target, which permits the crew not to intervene subsequently in its guidance process but to immediately execute an evasive maneuver and shift to executing another mission.

American experts categorize the aforementioned qualities among the advantages of the Walleye-I guided bombs. At the same time, they also note a number of its deficiencies: possibility of its use only during the day under simple weather conditions with sufficiently good optical visibility of the target, and the impossibility of bombing from low and extremely low altitude because of a lack of time for the operator to process the target and the long reaction time of guided bombs to control commands. In addition, the flight range of this guided bomb is not much more than for conventional bombs and is basically dictated by the altitude and speed of the airborne platform at the moment of bombing.

Subsequent work on Walleye guided bombs led to creation of the second generation Walleye-II Mk 5 Mod 4 guided bomb. It is equipped with a more powerful high explosive warhead and well-developed arrangement of aerodynamic surfaces supporting a maximum flight range of up to 40 km when released at subsonic speed from an altitude of around 9,000 m. A subsequent modification of this bomb (Walleye-II Mk 13 Mod 0) has improved aerodynamic efficiency and can glide for a distance of up to 65 km. The TV-command guidance system of the Walleye-II bomb permits the crew to bomb targets with known coordinates in the absence of visual contact with them. The guided bomb is guided by the operator using a radio command line from the TV image which is relayed from the bomb to the airborne platform. After release of guided bombs the aircraft can get on the return course. Such a maneuver does not hinder the operator in controlling the bomb right up until it hits the target. By orienting himself on easily visible objects the operator can guide such bombs to low-contrast and camouflaged targets even in the presence of clouds between the aircraft and the guided bomb. The long gliding distance of the Walleye-II bombs makes it possible to use them without having the airborne platform enter the target air defense zone, which is considered to be an advantage of this type of guided bomb. Deficiencies of the bomb include dependence of tactical employment on weather conditions and time of day and the rather lengthy guidance process.

The basic directions in creating American guided bombs is their DEVELOPMENT BASED ON ORGANIC UNGUIDED HIGH EXPLOSIVE BOMBS of 500, 1,000, 2,000 and 3,000 pounds. The foreign press notes that such factors as the presence of an enormous reserve of organic bombs, low effectiveness of their tactical employment against targets and hardened air defense systems, and the increasing cost of modern attack aircraft prompted developers to think about modernizing the existing reserve of unguided bombs and converting them to the category of guided precision weapons. The process of such a conversion consists of equipping organic bombs with command and guidance equipment sets and increasing the area of stabilizers, which in guided bombs perform functions of a wing. The overall design of the bombs and their suspension systems are not being changed.

The GBU-8 and GBU-9 guided bombs with TV guidance systems became the first models of guided bombs created on the basis of high explosive 2,000 pound (Mk 84) and 3,000 pound (M118) high explosive bombs respectively. Their development was conducted in parallel and was completed almost simultaneously in 1969. It has been reported in particular that they possess all the advantages and deficiencies of the Walleye-I guided bomb but have more powerful warheads and cost less.

During 1971-1972 the United States completed the Paveway-I program to create the first generation of guided bombs with semiactive laser guidance based on organic bombs. Three guided bombs were developed as a result: GBU-10 (based on the Mk 84 bomb), GBU-11 (M118) and GBU-12 (Mk 82). Bombs of these types are fitted with semiactive laser guidance and control systems which differ slightly from each other and which are based on a microprocessor. All systems are brought together in a single control and guidance section joined to the head of the standard bomb with the help of an adapter ring. During combat employment a target detected by the operator is illuminated by the laser

target illuminator (laser target designator) aboard the airborne platform. Emission reflected from the target is received by the guided bomb's laser homing head and, based on the latter's commands, the control system deflects the bomb's control surfaces in a particular direction depending on the guidance error sign.

It is believed that in comparison with guided bombs having TV homing heads, guided bombs with laser guidance can be employed against targets with lesser optical contrast. The semiactive laser guidance system permits a crew to choose targets located close together in a more differentiated manner and hit them. This system is simpler and cheaper than the TV system in design execution. At the same time it also has an inherent deficiency, which is that the operator must track the target with the laser beam during the entire flight of the bomb to the target, which constrains the crew's actions and hampers execution of evasive maneuvers. Subsequently laser target designators were modified and began to track the target automatically during the aircraft's evolutions. But the requirement for illuminating targets before the bombs hit them remained mandatory for all subsequent generations of semiactive laser systems, which in the opinion of western specialists is one of their fundamental deficiencies.

In 1978 second generation guided bombs with semiactive laser homing heads created as a result of the Paveway-II program came into the U.S. Air Force inventory. They include the modified GBU-10 and GBU-12 bombs as well as the GBU-16 created on the basis of the standard Mk 83 1,000 pound bomb. The primary distinction of these bombs is that they are equipped with new semiactive laser homing heads with coding device. The latter permits synchronizing homing head operation with a specific target designator. This precludes guidance of guided bombs to a "strange" laser spot and thus guidance of several bombs to one and the same target is precluded during a group attack by airborne platforms. In addition, the coding device precludes the possibility of guiding such bombs to dummy laser spots created by the enemy, which improves the ECCM of the guidance system. In the Paveway-II series of guided bombs the fixed wing is replaced by a folding wing, which reduces the dimensions of the bombs and allows increasing the number suspended on an aircraft. The foreign press notes that the objective pursued in creating these bombs was to simplify the production process and reduce their cost.

According to foreign press reports, experience in employing laser-guided bombs in Southeast Asia and the Near East demonstrated their rather high tactical capabilities. Noted above all was the high accuracy of hitting the target and there was a sharp reduction in the number of aircraft and weapons for destroying a target. Substantial deficiencies were revealed at the same time: this weapon could be used only during the day under simple weather conditions, with weak opposition on the enemy's part, and chiefly from medium flight altitudes. During the Anglo-Argentine conflict over the Falkland (Malvinas) Islands the British Air Force employed guided bombs from a dive against small targets illuminated by ground laser target designators. The guided-bomb airborne platforms would approach the target at an altitude of around 150 m, concealed behind elevations. Before reaching the target they would pitch up and release guided bombs at a pitch angle of around 30 degrees. Bomb release was executed so that the laser homing head would pick up the beam reflected

from the target on the downward leg of the bomb's path. A total of four bombs were released, of which two made direct hits on the target and two fell short.

The United States carried out a special Paveway-III program during 1979-1984 for creating guided bombs for actions from low and extremely low altitudes, and as a result a third generation laser-guided bomb was developed: the GBU-22 (based on the second generation GBU-12), GBU-23 in two versions (based on the GBU-16) and GBU-24 (second generation GBU-10). These bombs were given an increased glide range by equipping them with a wing of increased area, by optimizing the flight path selected by autopilot, and by equipping them with a gyroplatform and microprocessor which produces control commands. One version of the GBU-23 bomb (designated the AGM-123A) is equipped with a solid fuel rocket engine, which substantially increased the guided bomb's flight range when employed from low and extremely low altitudes.

It is reported that tactics of employing the third generation guided bombs are similar to those used by the British Air Force in the Falklands. Earlier during the aggressive war in Vietnam the Americans developed similar bombing methods. Inasmuch as it is very difficult for the airborne platform to illuminate the target with its own equipment when releasing guided bombs from low and extremely low altitudes, this task is assigned either to ground target designators or on-board designators accommodated in other flying craft (aircraft, helicopters or remotely piloted vehicles). For coordination of the actions of the guided-bomb airborne platform crew and laser target designator operator, they need a line of communciations and very precise synchronization of actions in time. All this imposes certain limitations on use of such bombs, but the advantages achieved--a reduction in losses of friendly aircraft, surprise, and high effectiveness of the strike--prompt American military specialists to persistently improve low-altitude guided bombs, target designation equipment and tactics of employing them.

The GBU-17 bomb with laser guidance, development of which was completed in 1982, holds a special place among guided bombs. This special bomb is intended for destroying especially tough targets (buried command posts, communications centers, tunnels, depots, underground and semiburied shelters, hardened missile launchers, protective works and so on). It is fitted with the HSM dual-action warhead contained in an especially strong case. When the bomb hits the target the shaped charge in the nose is triggered and it punches a deep channel in the obstacle, to where a high explosive warhead charge penetrates and detonates with a certain delay. Tests have shown that the bomb can demolish reinforced concrete slabs up to 4.5 m thick without ricocheting.

In the mid-1970's the United States began work of creating GUIDED BOMBS OF MODULAR DESIGN. In accordance with the program, two types of gliding guided bombs were being developed simultaneously: with cruciform wing and a glide range up to 50 km for use from low and medium altitudes (this version was designated the GBU-15 at the end of development) and with an uncambered@ wing opening in flight and a glide range up to 70 km for operations from high altitude (GBU-20). Development of these guided bombs was completed in 1980 and 1984 respectively. The guided bombs which were created have around 80 percent of identical design elements and consist of exchangable modules of aerodynamic components, warheads and control and guidance systems. The

optimal variant of the weapon having greatest effectiveness can be assembled from these modules depending on conditions of tactical employment and the type of target. As American experts assume, this will allow expanding the range of missions accomplished by aviation during the day and night in all weather conditions with a limited type range of guided bombs.

The following can be used as warhead modules: the warhead of the Mk 84 2,000 pound high explosive bomb; CBU-75 cluster units filled with small-caliber high-explosive, fragmentation, shaped-charge or concrete-piercing bombs; the penetrating, concrete-piercing HSM warhead; fuel-air explosive warhead and others.

The most developed among guidance system modules is considered the TV-command system. Replacement of the TV camera in this system with a thermal-imaging homing head standardized with the Maverick air-to-surface guided missile homing head will make it possible to use guided bombs in adverse weather conditions and at night. It is also reported that a semiactive laser guidance system module has been developed for the GBU-15 in case of its use at short range.

As foreign military specialists believe, despite high effectiveness, the one-time use of the TV, laser and thermal-imaging gear of guided bombs is a costly measure. Therefore the developers are seeking those guidance systems where the main equipment would be accommodated not in the bomb but aboard the airborne platform. One version of such a system is a difference-ranging guidance system being created for outfitting the GBU-20 guided bomb above all. It consists of rangefinder gear accommodated in a pod suspended beneath the aircraft and a radio beacon installed aboard the bomb. During the flight of a guided bomb its position is determined by measuring the time of arrival of radio beacon signals at two or more interworking aircraft with known distances between them. Correcting commands are converted to control signals which go to the bomb's autopilot.

Foreign specialists include among advantages of the difference-ranging system above all the fact that neither the airborne platform nor the correcting aircraft are within the killing zone of the target's air defense system. After release of guided bombs the airborne platform can execute any maneuver after passing control of the bomb over to the correcting aircraft. In addition, this bombing method can be used day or night in all weather conditions. And finally, an advantage of this guidance method is the possibility of using guided bombs in the PLSS reconnaissance-attack systems.

It is believed that systems functioning in the LORAN ground system network, operation of which is based on the method of hyperbolic radio navigation, have approximately the very same advantages. The guidance principle of guided bombs in this system is similar to the difference-ranging method: instead of a radio beacon, a LORAN system transceiver is installed in the guided bomb and is used to calculate its coordinates on the ground and issue commands to adjust its flight. Both of these methods have been designated abroad as "blind" (over the horizon) bombing. The accuracy (circular error probable) achieved here for a hit on target of guided bombs is 15-30 m. "Blind" bombing methods can be used to hit large or area targets with previously reconnoitered

coordinates or for controlling guided bombs in the mid-course leg of the flight with terminal homing (TV, thermal-imaging) for hitting small and mobile targets.

A guidance method being worked out at the present time using NAVSTAR satellite navigation system signals also belongs to the "blind" method. Here the bomb is guided to a target with known coordinates based on results of a comparison made aboard the guided bomb of the target's coordinates and the bomb's current coordinates.

The AGM-130 is a further development of modular-design guided bombs. It is being created on the basis of the GBU-15 bomb by fitting it with a motor unit for achieving the greatest possible glide range from low and extremely low altitude. It is planned to use TV-command (thermal imaging-command) and semiactive laser guidance systems as guidance system modules on the AGM-130, and a high explosive and cluster warhead filled with various types of submunitions as warhead modules.

Reports have appeared recently in the foreign press about the Paveway-IV program aimed at further improvement of guided bombs. It is a component part of the Pentagon's program having as its objective the creation of precision weapons capable of destroying many targets day and night under all weather conditions in a single attack. An important component of the Paveway-IV program is considered the development of new millimeter and IR waveband homing heads which could autonomously detect, identify and lock onto targets after bomb release without crew intervention.

An autonomous guidance programmer is to be a part of future homing heads. Before employing guided bombs data will be input to this device about previously reconnoitered targets and after release each guided bomb will be guided independently to a preassigned target for destruction. It is planned to release all bombs in a single pass, which will considerably simplify crew actions and reduce the time the airborne platform is in the zone of active air defense weapons. But if the homing head provides sufficiently high resolution, then it will be possible to conduct bombing against an auxiliary aiming point to destroy camouflaged targets.

Judging from western press reports, the United States presently is conducting active work along all directions for creating guided bombs. This work is aimed at further increasing the power and effectiveness of warheads, at achieving higher hit accuracy, and at assuring operating capability of guidance systems day and night in practically all weather conditions and a high level of automation and autonomy of guided-bomb control system operation based on contemporary and future computer technology. At the same time, tactics of combat employment of guided bombs also are being improved.

6904
CSO: 1801/246

FRG AIR FORCE 44TH WING EXERCISE

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 43-44

[Article by Lt Col S. Vasilyev]

[Text] Within the framework of preparations for an aggressive war against the Soviet Union and other socialist countries, the Bundeswehr command attaches primary significance to the most rapid placement of units of all branches of the armed forces in full readiness to accomplish combat missions prescribed by plans for their operational employment.

The foreign press reports that in accordance with guidelines of the NATO leadership, the FRG Air Force command lately has been conducting a set of measures to exercise the Bundeswehr's existing system for converting all components of the Air Force from a peacetime to a wartime footing. The West Germans consider the following to be the most important of these measures: a regular call-up of reservists to participate in various exercises (as the western press attests, in case of mobilization it is planned to call up more than 90,000 reservists to the country's Air Force); a practice test of procedures for bringing existing units [chast and soyedineniye] up to wartime T/O&E strength in personnel and weaponry, as well as the system for converting skeletonized units and subunits into regular ones; an improvement in ways and methods of having all Air Force components achieve full combat effectiveness and readiness in short time periods to conduct combat actions under present-day conditions.

As reported in the West German press, in September 1985 the Bundeswehr Air Force conducted an exercise to convert the skeletonized 44th Fighter-Bomber Wing [FBW] (a part of the 1st Air Support Division, with division headquarters in Messstetten) into a regular unit. The exercise objective was to test plans for converting the 44th FBW from a peacetime to a wartime footing and making it ready to perform combat missions of providing air support to ground forces.

The following missions were practiced during the exercise: notification and assembly of reservists; bringing skeletonized auxiliary subunits up to authorized norms in personnel, weapons and military equipment (with their demothballing); execution of intensive flights with the delivery of ground attacks (using bombs, free-flight rockets and aircraft cannon) from low altitude against ground targets both conditionally and practically on ranges;

instilling in the personnel, and above all the reservists, skills of using and servicing organic weapons; and organization of security and air defense of the Leipheim Airfield, POL and ammunition depots and other wing targets.

According to the foreign press, in peacetime the 44th FBW is assigned only one fighter-bomber squadron (all regular wings each have two squadrons), the aircraft of which (light Alpha Jet attack aircraft) are employed as operational trainers at the Bundeswehr Air Force Flight Center at the Beja Air Base (Portugal) and partially in the 49th FBW (Fuerstenfeldbruck Air Base, FRG).

Judging from West German press announcements, at the beginning of the exercise the squadron of light Alpha Jet attack aircraft was rebased from Portugal to the Leipheim Airfield, the 44th FBW's permanent basing point. In addition, the following were transferred to the wing: a portion of the Alpha Jet aircraft from the aforementioned 49th FBW; the 31st Technical Group for repair and servicing of this type of aircraft (Leipheim); 4th Company, 4th Training Regiment of the FRG Air Force (Leipheim); 244th AAA Battery; and a number of airfield service and security subunits.

There were 1,228 reservists called up to bring the wing up to authorized wartime personnel strength. Only 840 arrived; the others were excused from arriving in the unit for various reasons deemed valid by district draft points. In addition, over 260 regular servicemen from other Air Force subunits stationed in the vicinity of the Leipheim garrison were sent to the wing. The total personnel strength of the 44th FBW was brought to 1,843 persons during the exercise, which was approximately 83 percent of its authorized wartime strength of 2,230.

The foreign press reported that after being brought up to strength the 44th Wing had 21 Alpha Jet attack aircraft and 24 pilots. During the exercise they flew 374 aircraft-sorties (alone and as part of groups, see figure [figure not reproduced]), of which 136 were to ranges to practice techniques of bombing and destroying ground targets with aircraft cannon fire and free-flight rockets. The intensity of flights was 50 aircraft-sorties per day.

During the exercise great emphasis was placed on rapid activation of the called-up reservists, the number of which, according to foreign press data, reached 55 percent of the wing's overall personnel strength. Above all this included command cadres of the AAA subunits, communicators, as well as technical specialists for servicing aircraft weapon systems, ground electronic equipment and aviation munitions. For example, during the exercise a group of reservists performed a routine inspection and minor repairs, and a check of the electrical equipment of a number of Alpha Jet systems, and loaded them with bombs, rockets and rounds under the direction of regular NCO's to gain practical experience.

There was a check of the readiness of the rear service to supply the wing with munitions, POL, food and other kinds of supplies simultaneously with practice of the aforementioned matters.

According to an assessment of the Bundeswehr Air Force command, the exercise of converting the skeletonized 44th FBW to a regular wing went successfully on the whole. In particular, certain experience was gained in urgently moving combat aircraft over a long distance to a permanent basing location, demothballing weapons and military equipment, organizing intensive training of subunits manned by reservists, and achieving the requisite level of wing combat readiness in short time periods.

6904
CSO: 1801/246

AMERICAN ELECTRONIC AIRCRAFT LANDING SYSTEM

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 44-46

[Article by Lt Col R. Dasayev]

[Text] Within the overall complex of militaristic preparations the Pentagon intends to re-equip all branches of the Armed Forces in the 1990's with new navigation systems and equipment because, as American military specialists believe, equipment with a similar purpose in the inventory is obsolete and does not meet present-day requirements for accuracy, range, antijam capability and operating reliability. The primary role in implementing these plans is given to the NAVSTAR global satellite radio navigation system, deployment of which is planned to be completed in 1988. Meanwhile, replacement of existing course-and-glide and ground controlled approach aircraft landing systems with the new MLS (Microwave Landing System) course-and-glide/rangefinding system operating in the centimeter radio wave band, planned for the period 1986-1995, is considered an important measure in improving navigation support to U.S. military aviation.

The effectiveness of employing combat aviation depends to a considerable extent on its capability of performing missions day and night in adverse weather conditions, which in turn is connected with the equipping of airfields with electronics as well as with the capabilities of flight crews to take off and land aircraft under such conditions. Judging from western press reports, the contemporary ILS (Instrument Landing System) course-and-glide landing system does not provide continuous and accurate measurement of distances from the aircraft to the runway and has an insufficient width of the aircraft control zone in the air and low accuracy in determining their position. The system's equipment is cumbersome and does not meet requirements for reliability, and its operation is considerably influenced by the nature of terrain, soil moisture, the presence of local objects and amount of snow cover in the airfield area. The UHF frequency band chosen in the ILS system does not ensure creation of stable equisignal zones at heights below 30 m, which precludes automatic landing. In addition, the system does not allow choosing angles of glide path inclination optimal for a given type of aircraft, and the landing approach is made only at angles of 2-3 degrees.

In the new MLS system these deficiencies are remedied by using the centimeter wave band as well as new circuit and engineering solutions in the basic gear

(synchronous electronic scanning of antenna radiation pattern beams, use of phased antenna arrays, microprocessor technology and solid-state component base, and so on). This system permits solving such problems as increasing throughput by severalfold, performing automatic landing, determining the aircraft's (helicopter's) position by course and glide path with high accuracy, and ensuring the simultaneous landing of aircraft on nearby parallel runways.

The set of ground equipment of the MLS system includes two localizer beacons (one for supporting a landing from the main direction, and the other from the opposite direction); two glide-path beacons, which additionally ensures precise control of the aircraft in leveling off on the final leg; and rangefinder equipment. The set of MLS system on-board equipment will include a receiver for ground beacon signals, a processor and a range-only radar.

The MLS system localizer beacon emits coded signals and forms two beams scanning toward each other within limits of angles of ±40°. When the aircraft is at a certain angle to the runway axis its gear picks up the signal of the first and then the second beam. The time between these receptions is proportionate to the aircraft's deviation from the runway axis; when the aircraft or helicopter is on the runway axis signals from the first and second beams coincide. In addition to giving the pilot an indication of course and glide-path angles, the MLS system measures distance to a certain point on the airfield, the point where the localizer beacon is located, which increases the landing precision and reliability. The localizer and glide-path beacons operate on the same frequency in the 5,000 MHz band in a signal time division mode.

Based on a wide diversity of conditions for use, the ground complex of MLS system equipment intended for installation at fixed military airfields is to be made in six versions: four standard versions, an improved version and a simplified version (their basic characteristics are given in the table below). MLS system signals for fixed airfields will be received at distances of up to 35 km. The rate of arrival of localizer beacon data at aircraft equipment equals 13.5 Hz, and that of data of the glide-path and range-only equipment is 40 Hz. Position finding errors of the aircraft (helicopter) should not exceed 3 m; in the opinion of American specialists, this will ensure execution of automatic landings.

Basic characteristics of system ground complexes

Ground Complex Variants	Width of Course Antenna Radiation Pattern, degrees	Course Control Zone, degrees	Width of Glide Path Antenna Radiation Pattern, degrees	Glide Path Control Zone, degrees
I	2	±40	1.5	0.9—15
II	2	±40	1	0.9—15
III	1	±40	1.5	0.9—15
IV	1	±40	1	0.9—15
	1	±60	1	0.9—15
	1	±10	1	0.9—15

Judging from foreign press reports, in addition to the MLS equipment ground complex, the United States plans to create a mobile version of the system for fixed airfields which can be easily deployed at forward airfields. It is to support a landing on dirt runways with a slope of up to 10 degrees with structures, trees and electronic equipment antennas nearby and under conditions of dense air traffic. Inasmuch as such a system will perform tasks under conditions of active enemy ECM, its radiated power is to be reduced to a minimum permissible value, which will permit controlling a landing at short ranges. The signal emission zone also must be minimal to preclude radiating signals toward the enemy. The effective range of the mobile version of the MLS system will be 18 km, the course control zone will be 40°, and the glide-path control zone will be from 0 to 20°. The radio beacons will operate on a frequency of 5,000-5,100 MHz and support a landing with a cloud ceiling of 30 m. It is planned to install beacon equipment together with the phased antenna array on a tripod. The beacons weigh around 90 kg and the aircraft (helicopter) equipment weighs up to 10 kg.

The foreign press notes that a deck version of the MLS system is being created for U.S. Naval Aviation in place of the existing AN/SPN-41 instrument landing system. It is to support the landing of aircraft or helicopters on an aircraft carrier.

The MLS system presently is in the final phase of full-scale development. It is reported in particular that ground and on-board equipment successfully passed tests under various climatic conditions. The American firms of Hazeltine, Bendix and Wilcox are engaged in creating the MLS system. In early 1984 Hazeltine was allocated $90.6 million for production and installation of 172 ground sets of the MLS system (see diagram [diagram not reproduced]) at U.S. airports over a period of five years. During 1986-1990 Hazeltine is to manufacture 326 ground sets of the standard version of the MLS system for the U.S. Air Force for installation at fixed airfields, up to 250 mobile ground sets, as well as some 30 radio beacons to be moved by air transport.

The Hazeltine MLS system was developed on the basis of the Type 2500 Microwave Landing System. A number of airports of the United States, Canada, Great Britain and Italy have been equipped with experimental sets of this equipment for tests. The system at the helidrome in New York City provides the capability of a landing approach within limits of ±10° in azimuth and 0.9-20° in elevation.

According to foreign press reports, the American command plans to install on-board gear of the MLS system in all military aviation aircraft by 1995, and armed forces of the other imperialist NATO bloc member countries will be refitted with the new system by the year 2000.

6904
CSO: 1801/246

THE FRENCH NAVY

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 47-54

[Article by Capt 2d Rank S. Grechin; passages rendered in all capital letters printed in boldface in source]

[Text] The French Navy, which is a NATO bloc participant, holds third place following the United States and Great Britain among navies of capitalist states in total numbers of ships, aircraft and helicopters as well as in outfitting with modern weapon systems, and western military specialists believe that it is inferior only to the United States in sea-based strategic nuclear forces and carrier-based airborne platforms.

According to foreign press reports, the Navy is assigned to accomplish the following basic missions: delivery of nuclear strikes against enemy administrative-industrial centers and military targets, winning supremacy in specific sea areas with the use of tactical nuclear weapons and conventional weapons, defense of sea lines of communication [SLOC], defense of the country's seacoast, and support to other branches of the armed forces. In addition, the French military-political leadership attaches great importance to defense of so-called national interests and demonstration of military presence in various ocean and sea areas often considerably remote from the French coast.

The Navy is an independent branch of the armed forces and consists of a fleet, naval aviation and marines. It is headed by a chief of staff (who also is the CIC), who is responsible for developing current and long-range plans for organizational development and employment of the Navy, for operational and combat training and combat readiness, and for comprehensive logistical support to units and ships, and he specifies requirements for personnel, weapons and military equipment. The basic subdivisions of the Navy staff are the planning, operations, logistics, and shipbuilding and armaments departments as well as communications, documents, and military history services.

The Navy is subdivided according to its objective purpose into strategic and general purpose naval forces.

The ORGANIZATIONAL STRUCTURE provides for the presence in the Navy of a strategic naval command authority and six operations commands (in the

Atlantic, Mediterranean, in the Indian and Pacific ocean zones, in the South Atlantic, as well as in Guiana and the Antilles, Fig. 1).

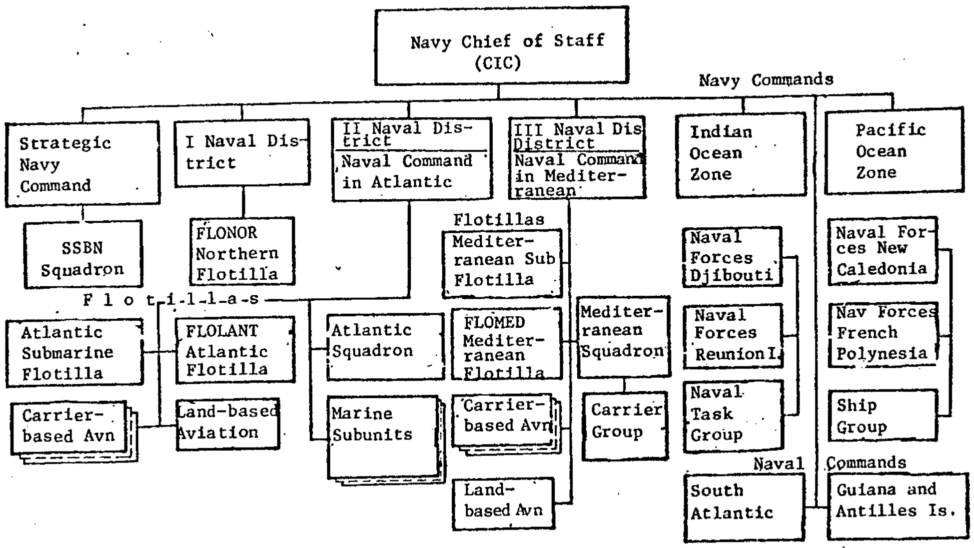


Fig. 1. Organization of the French Navy

The French coast and contiguous waters are divided into three naval districts (VMO): I (headquarters at the Cherbourg Naval Base) includes the coast of the English Channel and North Sea, II (Brest) includes the Atlantic coast and III (Toulon) the Mediterranean coast. The CIC of the II Naval District is at the same time CIC of naval forces in the Atlantic, and the CIC of the III Naval District is CIC of naval forces in the Mediterranean. The CIC's of naval districts are responsible for maintaining a favorable operations regime in the zone, organizing day-to-day activities of subordinate forces and resources, and providing defense of the coast, naval bases and ports and protection of coastal SLOC. In addition, they are assigned functions of border guard service and coordination of actions in conducting search and rescue operations at sea.

The STRATEGIC NAVAL COMMAND is one of the most important components of France's strategic nuclear forces. In the assessment of western specialists, it accounts for some 70 percent of nuclear weapon platforms. The command includes a squadron of nuclear-powered guided missile submarines (SSBN's), a strategic naval forces base, and a communications center at Rosnay.[1] The squadron has six SSBN's (five of the "Le Redoutable" Class--the S 611 "Le Redoutable," S 612 "Le Terrible," S 610 "Le Foudroyant," S 613 "L'Indomptable," S 614 "Le Tonnant" and S 615 "L'Inflexible"[2]). Each SSBN is armed with 16 balllistic missiles. The "L'Inflexible," which went out on her first combat patrol in 1985, has M4 missiles with multiple re-entry vehicles (six independently targetable 150 KT warheads) and a firing range of some 4,500 km. The other submarines are equipped with M20 missiles with a single 1 MT thermonuclear re-entry vehicle and a range of fire of 3,200 km.

The NAVAL COMMAND IN THE ATLANTIC includes two Atlantic flotillas (of submarines and the FLOLANT of surface combatants), an Atlantic squadron of

surface combatants, as well as carrier-based and land-based patrol aviation of the II Naval District and marine subunits. In addition, in wartime the FLONOR Northern Flotilla of surface combatants from the I Naval District may be made operationally subordinate to the command authority. According to foreign press data, the command can include 8-10 diesel submarines, up to 50 surface combatants, some 30 small combatants and over 100 combat aircraft and helicopters.

The MEDITERRANEAN NAVAL COMMAND includes two Mediterranean flotillas (of submarines and the FLOMED of surface combatants), a Mediterranean squadron of surface combatants which includes a carrier group (two multirole carriers--R 99 "Foch" and R 98 "Clemenceau," Fig. 2 [figure not reproduced]), and carrier-based and land-based patrol aviation of the III Naval District. The foreign press indicates that the fighting strength of the command may number up to 10 attack submarines, including two nuclear-powered submarines, some 25 surface combatants, and up to 150 combat aircraft and helicopters.

Organizationally the flotillas and squadrons of surface combatants consist of divisions [divizion] of destroyers and guided missile frigates, guided missile patrol boats, minesweeping ships and auxiliary vessels.

The NAVAL COMMAND IN THE INDIAN OCEAN ZONE unites naval forces and resources in Djibouti and on Reunion Island, as well as a naval operations group. The fighting strength usually numbers some 15 combatants and 2-3 patrol aircraft. Some of the ships are in the zone on a permanent basis and the operations group is formed from naval commands in the Atlantic and Mediterranean. These ships are in the Indian Ocean zone for an average of 3-5 months.

The NAVAL COMMAND IN THE PACIFIC ZONE includes naval forces (up to 15 combatants) and resources based at New Caledonia and in French Polynesia as well as a group of ships of the Pacific Nuclear Test Center. Some ships of the French Navy, including nuclear-powered submarines, make lengthy training cruises to the Pacific Ocean. One of the important naval missions in this zone is support of French nuclear weapon tests.

The NAVAL COMMANDS IN THE SOUTH ATLANTIC, GUIANA AND THE ANTILLES have 2-3 patrol and landing ships. In wartime it is planned to subordinate these forces to the CIC of naval forces in the Atlantic.

STRENGTH, ORDER OF BATTLE AND PROSPECTS FOR DEVELOPMENT OF THE NAVAL FORCES. According to foreign press data, the total personnel strength of the Navy as of mid-1986 was 68,000 persons (57,700 in the fleet, 9,300 in naval aviation and 1,000 in the marines).

The FLEET has some 350 combatant ships, small combatants and auxiliary vessels in its order of battle, including six SSBN's, two nuclear-powered submarines and 16 diesel submarines (of which the S 655 "Gymnote" is experimental), two multirole aircraft carriers, a helicopter cruiser,[3] guided missile cruiser, 13 guided missile destroyers, 25 guided missile frigates, three destroyers, a frigate, 19 landing ships, 28 minesweeping ships, as well as five guided missile patrol boats, 10 motor patrol boats and 38 landing craft.

The French naval command places special emphasis on the development of fleet submarine forces, with reliance placed on nuclear-powered submarines. The decision has been made to build a seventh SSBN; foreign military specialists expect her to be commissioned in 1994. It is planned to create the M5 missile or improve the M4 missile for her. At the same time, a program has been developed for improving the combat capabilities of existing submarines basically by refitting them with M4 missiles before 1992. In 1985, for example, the SSBN "Le Tonnant" was put up for refitting and scheduled major overhaul.

In 1983 two nuclear-powered multirole "Rubis" Class submarines (SSN's) (the S 601 "Rubis" and S 602 "Saphir") became part of the fleet. Another three such submarines are in various stages of construction and one has been ordered. It is planned to have at least eight SSN's by the mid-1930's [sic] fitted with the Exocet SM-39 antiship missiles and to form a submarine flotilla on their basis. The western press reports that the French naval command presently has no intention of building diesel-powered submarines.

The program for building new nuclear-powered multirole aircraft carriers holds an important place in development of naval surface forces. According to foreign press reports, the first nuclear-powered aircraft carrier was laid down in January of this year and her commissioning is expected in 1995. It is planned to build a second nuclear-powered carrier by 1998. They are to replace the multirole carriers "Clemenceau" and "Foch," which have been in the naval order of battle since the early 1960's.

A program for building guided missile destroyers also is being carried out. Five "Georges Leygues" Class ships are in various stages of construction (Fig. 3 [figure not reproduced]), three of which primarily have antisubmarine weaponry and two are in the air defense version (the lead ship is the "Cassard"). They are expected to be transferred to the fleet during 1986-1990. This year it is planned to issue an order for a lead Project FL 25 guided missile frigate (the first three ships may be commissioned in the Navy in the early 1990's). These ships, with a displacement of around 3,000 tons, are planned to be armed with the Exocet antiship missile system, the Crotale and Sadral surface-to-air missile systems, a 100-mm general-purpose gun mounting, two 20-mm gun mountings, and torpedo tubes. The foreign military press notes that they will be for actions as part of the French Rapid Deployment Force.[4]

Considerable changes are expected in the make-up of landing and minesweeping forces. The first Project TCD 90 dock landing ship was laid down in 1985. Completion of her construction and transfer to the fleet is planned for 1990. Two more such ships are planned to be built, and will be ordered in 1986 and 1988. Judging from data published in the French press, a ship of this class is capable of simultaneously taking aboard one-third of a mechanized regiment (up to 470 persons) with its attached combat equipment. An order was issued in 1984 for building two such EDIC Class ships to replace obsolete tank landing ships. According to articles in the reference work "Jane's," construction is under way on ten "Eridan" Class minesweeper/hunters (under the Tripartite Project). Five ships already have been transferred to the Navy and it is planned to commission the others during 1986-1989. They will replace

"Sirius" Class minesweepers and partially the American built "Aggressive" Class.

A program also is being implemented for building new motor patrol boats. Six out of ten P400 Class patrol boats already have been commissioned and it is planned to transfer the others to the Navy in 1986. They are to be employed as part of commands in overseas territories above all.

The foreign press notes that fulfillment of planned programs for building combatants equipped with antiship, ship-to-air and antisubmarine missile systems as well as modern technical equipment not only will permit updating the ship order of battle, but also substantially increasing the Navy's combat capabilities.

NAVAL AVIATION is subdivided into combat (carrier-based and land-based) and auxiliary aviation. Combat aviation has a total of some 150 aircraft and up to 60 helicopters.

Carrier-based aviation includes three squadrons of Super Etendard fighter/attack aircraft, which are nuclear weapon platforms (a total of 60 aircraft), one fighter (Crusader) squadron, one reconnaissance (Etendard IV P) squadron, two squadrons of antisubmarine aircraft (Alize), as well as four squadrons of antisubmarine helicopters (Lynx, Super Frelon) and one squadron of assault transport helicopters (Super Frelon).

Land-based aviation is represented by four patrol squadrons (over 30 Atlantic aircraft).

Auxiliary aviation has up to 200 aircraft and helicopters in 12 squadrons (training, communications, service, equipment test, and rescue).

Aircraft of naval aviation are the Super Etendard fighter/attack aircraft. Beginning in 1988 it is planned to equip these aircraft with air-to-surface guided missiles with nuclear warheads and a range of fire up to 300 km. Forty-two new Atlantic-2 aircraft have been ordered for land-based patrol aviation, with series production to begin in 1988.

The MARINES are for participation in amphibious landing operations as part of the first wave of an assault force, conducting reconnaissance-sabotage operations, securing important naval facilities, and performing police functions aboard ships. They includes the following companies: reconnaissance-sabotage (four), frogmen, naval facility security (six), and other subunits.

The French Navy is MANNED on the basis of the law on universal military obligation and by recruiting volunteers under long-term contracts (of at least three years). First-term service is 12 months long and the draft age is 18.

Draftees and volunteers undergo basic training in the naval training center at Urten (Brest) for 1.5 months,d then first-term personnel are sent to ships and units, where they learn a specialty. As a rule, this category of servicemen is appointed to positions in accordance with their civilian specialty or to positions not requiring lengthy training.

After signing a contract, volunteers take the basic training course, choose one of the naval specialties and train at the naval training centers of St. Mandrier (Toulon), Couerleville (Cherbourg), Urten and in air training squadrons of Rochefort and Nimes-Garons. NCO training takes place at various courses of the training centers.

Officer personnel are trained from among civilian youth and servicemen under contract at the Naval School at Lanveoc-Poulmic, at the quartermaster school (Toulon) and the administrative school (Cherbourg). Training time is two years. After completion of school graduates receive an initial officer rank of junior lieutenant. Officers on ship duty then are sent to the helicopter cruiser "Jeanne D'Arc," where they undergo a year's on-the-job training. Officers receive higher military education at the higher naval school (Paris) and some senior officers (captains 1st rank and higher) at the military research center (Paris).

Officers usually serve in one position for no more than three years, with shipboard duty alternating with duty on naval staffs and in naval shore establishments. In addition, they may be sent to various naval schools for advanced training for 6-10 months.

In the assessment of the French command, the naval forces have a well-developed BASING SYSTEM both on the territory of France and abroad. The main naval bases are Brest, Toulon (the main ones), Cherbourg, Lorient, La Pallice; basing points are Isle Longue, Dakar (Senegal), Fort-de-France (Antilles), Djibouti and Reunion Island (Indian Ocean), Papeete and Noumea (Pacific Ocean). In addition, large commercial ports can be used for basing, logistics and repair of naval ships.

Carrier aviation is based at the air bases of Landvisiau (Brest) and Hyeres (Toulon), land-based patrol aviation at Lann Bihoue (Lorient) and Nimes-Garons, and helicopters at Lanveoc-Poulmic and St. Mandrier.

As the foreign press reports, naval OPERATIONAL AND COMBAT TRAINING is conducted rather intensively and is aimed at keeping the staffs, units [soyedineniye and chast] and ships in a high degree of combat readiness to accomplish their missions. During exercises conducted both under national plans as well as under plans of the NATO Joint Naval Forces Command (Isle d'Or, Display Determination, Ocean Safari, Norminex and others), primary emphasis is placed on practicing problems of converting naval forces from a peacetime to a wartime footing, forming task forces and deploying them to assigned areas, and organizing coordination with other branches of national armed forces as well as with multinational ship forces. In addition, great emphasis is placed on the conduct of opposed-forces exercises, above all with naval forces of African countries which at one time were French colonies. Lengthy cruises to various parts of the ocean occupy an important place in the training of naval ships. They have the objective not only of improving the personnel's naval schooling, but also demonstrating French naval presence.

The French Navy, which has strategic and tactical nuclear weapons, holds a leading place in the system of national armed forces. The country's military-political leadership does not preclude the possibility of their employment also as part of the NATO commands in the Atlantic and Southern European theaters, which is confirmed by operational and combat training activities.

Performance characteristics of the main types of French Navy ships

Ship Class-number in commission (hull number & name), year commissioned	Displacement, tons: Standard / Full load	Principal dimensions, m: length / beam / draft	Power plant output, hp / Maximum speed, knots	Range, nm / At a speed, knots	Crew (officers)	Armament[1]
1	2	3	4	5	6	7
Nuclear Powered Strategic Submarines						
"Le Redoutable"--6 (S610-615), 1971-1985	7900[2] / 9000	128 / 10.6 / 10	15 000[3] / 20 (15 000 / 25)	Unlimited	135 (15)	M4 or M20 SLBM--16; 533-mm torpedo tube --4 (18 torpedos)
Nuclear Powered Attack Submarines						
"Rubis"--2 (S601, 602) 1983-1984	2385 / 2670	72.1 / 7.6 / 6.4	(48[4] / 25)	Unlimited	66 (9)	533-mm torpedo tubes--4 (torpedos, mines, Exocet antiship missiles)
Diesel Powered Attack Submarines						
"Agosta"--4 (S620-623), 1977-1978	1470 / 1790	67.6 / 6.8 / 5.2	3600 / 12 (4600 / 20)	8500[5] / 9 (350 / 3,5)	52 (7)	533-mm torpedo tubes--4 (20 torpedos, mines)
S655 "Gymnote"[6], 1966	3340 / 3870	83.8 / 10.9 / 7.7	3000 / 11 (2600 / 10)	5500 / 7 (· / ·)	78 (8)	SLBM launchers--2
"Daphne"--9 (S641-643, 645, 646, 648-651), 1964-1970	860 / 1038	57.8 / 6.8 / 4.6	2400 / 13,5 (2600 / 16)	10 000 / 7 (150 / 3,5)	46 (6)	550-mm torpedo tubes--4 (12 torpedos)
"Narval"--2 (637, 638) 1960	1635 / 1910	77.6 / 7.8 / 5.4	3600 / 15 (4800 / 18)	15 000 / 8 (150 / 3,5)	63 (7)	533-mm torpedo tubes--6 (20 torpedos)
Multirole Aircraft Carriers						
"Clemenceau"--2 (R98 "Clemenceau" & R99 "Foch") 1961-1963	22 000 / 32 780	265 / 31.7 / 8.6	126 000 / 32	7500 / 18	1338 (64)	Acft & helicopters --40; 100-mm automatic mounting--8x1
Guided Missile Cruisers						
C611 "Colbert", 1959	8500 / 11 300	180.8 / 20.2 / 7.7	86 000 / 31,5	4000 / 25	560 (24)	Exocet antiship missiles--4x1; Masurca SAM--1x2; 100-mm auto mount--2x1; 57-mm auto mount--6x2
Helicopter Cruiser						
R97 "Jeanne d'Arc", 1964	10 000 / 12 365	182 / 24 / 7.3	40 000 / 26,5	6000 / 15	809 (30)	Exocet antiship missiles--6x1; 100-mm auto mount --4x1; helicopters --8

[Table continued on next page]

1	2	3	4	5	6	7
Guided Missile Destroyers						
"Georges Leygues"--4 (D640 "Georges Leygues", D641 "Dupleix", D642 "Montcalm", D643 "Jean de Vienne"), 1979-1984	3830 / 4170	139 14 5.7	52 000 / 30	8500 / 18	216 (15)	Exocet antiship missiles--4x1; Crotale SAM--1x8; 100-mm auto mount--1x1; 20-mm auto mount--2x1; torpedo tubes--2x1; ASW helicopters Lynx--2
"Tourville"--3 (D610 "Tourville", D611 "Duguay-Trouin" D612 "De Grasse"), 1974-1977	4580 / 5745	152.8 15.3 5.7	51 400 / 31	5000 / 18	292 (17)	Exocet Ashp msls--6x1; Crotale SAM--1x8, Malafon A/S msl--1x1; 100-mm auto mount--2x1; 20-mm auto mount--2x1; torp tubes--2x1; ASW helicopters Lynx--2
D609 "Aconit", 1973	3500 / 3900	127 13.4 5.8	28 650 / 27	5000 / 18	228 (15)	Exocet Ashp msl--2x4; Malafon A/S msl--1x1; 100-mm auto mount--2x1; torp tubes--2x1
"Suffren"--2 (D602 "Suffren", D603 "Duquesne"), 1967-1970	5090 / 6090	157.6 15.5 6.1	72 500 / 34	5100 / 18	355 (23)	Exocet Ashp msl--4x1; Masurca SAM--1x2; Malafon A/S--1x1; 100-mm auto mount--2x1; 20-mm auto mount--4x1; torp tubes--4x1
D633 "Duperre", 1957	2800 / 3900	132.8 12.7 6.1	63 000 / 32	5000 / 18	272 (15)	Exocet Ashp msl--4x1; 100-mm auto mount--1x1; torp tubes, Lynx ASW helicopter
"Dupetit Thouars"--2 (D625 "Dupetit Thouars", D630 Du Chayla") 1956-1957	2750 / 3740	128.6 12.7 6.3	63 000 / 32	5000 / 18	277 (17)	Tartar SAM; 57-mm auto mount--3x2; torp tubes--2x3, 375-mm depth charge launcher
Destroyers						
D638 "La Galissonniere", 1962	2750 / 3740	132.8 12.7 6.3	63 000 / 32	5000 / 18	270 (15)	Malafon A/S--1x1; 100-mm auto mount--2x1; torp tubes--2x3; Lynx ASW helicopter
"Surcuffe"--2 (D627 "Maille Breze", D628 "Vauquelin"), 1956-1957	2750 / 3900	132.5 12.7 6.3	63 000 / 32	5000 / 18	260 (15)	Malafon A/S--1x1; 100-mm auto mount--2x1, 20-mm auto mount--2x1; torp tubes--2x3; 375-mm launcher
Guided Missile Frigates						
"D'Estienne d'Orves"--17[7] (F781-797), 1976-1984	950 / 1170	80 10.3 5.3	11 000 / 27	4500 / 15	79 (5)	Exocet Ashp msl--4x1 (on F792-797), & 2x1 (on F781, 783, 786, 787); 100-mm auto mount--1x1, 20-mm auto mount--2x1; torp tubes--4x1; 375-mm launcher
"Commandant Riviere"--8 (F725-728, 733, 740, 748, 749), 1962-1970	1750 / 2250	103 11.5 4.3	16 000 / 25	4500 / 15	167 (10)	Exocet Ashp msl--4x1; 100-mm auto mount--2x1; 30-mm auto mount--2x1; torp tubes--2x3, 305-mm depth charge lnchr
"Commandant Riviere"--1 (F729 "Balny"), 1971	1650 / 1950	103.7 11.7 4.8	16 000 / 25	8000 / 12	167 (10)	100-mm auto mount--3x1, 30-mm auto mount--2x1; torp tubes--2x3, 305-mm depth charge lnchr

[Footnotes to table on next page]

1. The number of missile and gun mountings, the number of rails (containers) and their tubes, as well as the number of torpedo tubes are indicated after the multiplication sign.

2. For submarines the numerator shows surface displacement and the denominator submerged displacement.

3. Power and speed in a surface condition are given without parentheses and in a submerged condition within parentheses.

4. Reactor thermal output is 48 megawatts.

5. The range for speed in a surface condition is given outside parentheses, and in a submerged condition within parentheses.

6. An experimental submarine intended for testing sea-based ballistic missiles.

7. The guided missile frigate F784 "Detroyat" is shown in Fig. 4 [figure not reproduced].

FOOTNOTES

1. For more detail on France's strategic naval command and plans for refitting the SSBN's from the M20 to the M4 missiles see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 4, 1984, pp 59-63 and No 10, 1985, p 74--Ed.

2. The S 615 "L'Inflexible" essentially does not differ in her performance characteristics from the "Le Redoutable" Class SSBN's but, as the foreign press reports, she has a reinforced pressure hull, changes have been made to the design of launch silos, and the sonar system and navigation and radio communications equipment have been improved--Ed.

3. The R 97 "Jeanne d'Arc" also is classified as an amphibious assault ship--Ed.

4. The foreign press also calls it the "Rapid Action Force"--Ed.

6904
CSO: 1801/246

A-6 INTRUDER AIRCRAFT

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 54-57

[Article by Col (Res) I. Kudrin under the rubric "At the Readers' Request"]

[Text] The first A-6 Intruder attack aircraft began to enter the U.S. Navy inventory in the early 1960's and were widely used in American imperialism's aggressive war in Vietnam.

According to the U.S. Navy command, up until now the Intruder attack aircraft has remained the only aircraft in carrier-based aviation and marine aviation capable of delivering strikes with greatest effectiveness against sea and coastal targets in any weather day and night, and accomplishing missions of troop air support and isolation of the combat zone.

Judging from foreign press reports, a total of 488 A-6A aircraft (the first modification) were built, some of which were refitted (the A-6B modification) for the standard-ARM antiradar guided missile. The others (the A-6C modification) were fitted with a forward looking infrared set and television gear operating with a low level of illumination.

Some 60 A-6A aircraft were refitted as KA-6D deck-based tanker aircraft which have a refueling system with flexible hose and cone (Fig. 1 [figure not reproduced]).

The EA-6A electronic warfare aircraft was developed on the basis of the A-6A in the mid-1960's; it has electronic intelligence equipment and an electronic suppression set (33 such aircraft were built). An advanced version, the EA-6B Prowler (see color insert [color insert not reproduced]) with more modern on-board equipment, was created in the course of modernization. Seventy-seven aircraft of this modification were ordered in 1969.

The foreign press noted that during operation of the attack aircraft serious deficiencies were identified such as the appearance of cracks in various airframe components and especially the wing. Seventy-six of the aircraft were grounded for this reason and appropriate restrictions on flight speed and maneuverability (overload) were made in 113 of them. An analysis of this phenomenon showed, as western specialists believe, that the length of the wing's life cycle for fatigue strength was unjustifiably increased in the late

1960's from 2,250 to 4,400 hours. Therefore the A-6A aircraft had insufficient reliability and required large labor inputs for maintenance. As a result a modernized version of the attack aircraft, the A-6E, was developed on the basis of the A-6A in the late 1960's; its flight tests began in 1970 and deliveries to combat units began in 1972. Some 200 A-6A aircraft were refitted as A-6E attack aircraft to maintain a constant number in the order of battle (Fig. 2 [figure not reproduced]).

The aircraft has two J52-P-8A Pratt & Whitney turbojet engines with a maximum thrust of 4,200 kg each and is fitted with an aerial refueling system.

Characteristics of the A-6E are given below based on foreign press data.

Aircraft weight, kg:	
Maximum take-off weight from aircraft carrier using catapult	26,600
Maximum take-off weight from conventional airfield	27,400
Maximum landing weight on deck	16,300
Maximum landing weight on conventional airfield	20,400
Weight empty	11,800
Maximum fuel weight, kg:	
In internal tanks	7,230
In external tanks	4,560
Speed, km/hr:	
Maximum near ground	1,000
Cruising	760
Landing	170
Maximum rate of climb near ground, m/sec:	
With two engines	43
With one engine	15
Service ceiling, m	13,600
Flight range with maximum load (5 percent fuel reserve, 20 minutes flight in landing area), km	1,700
Take-off run (to 15 m altitude), m	800
Landing run, m	640
Aircraft dimensions, m:	
Length	16.7
Height	4.9
Wing span	16.2
Wing span with folded wings	7.7
Wing area, m^2	49.1
Crew	2

The aircraft was fitted with modern (for that time) on-board equipment. It includes the multifunctional AN/APQ-148 radar, which is highly reliable but has low resolution. It provides a scan of the Earth's surface with moving target selection and terrain relief data for low-altitude terrain following flight. The AN/ASQ-133 digital solid-state computer operates together with the inertial navigation system, radio communications equipment, automatic flight control system and automatic system for built-in monitoring of the operation of on-board equipment. Data enter the computer in analog form from approximately 60 sensors and are converted to digital form for display on appropriate pilot and navigator displays. The multifunctional AN/AYA-1 [sic;

should be AN/AVA-1] is the basic display and is used for navigation, for the aircraft's arrival at the aircraft carrier's location, for the landing approach and, using the sighting-navigation weapon system control device, for selection of weapons and bombing or missile launch. The vertical situation display indicator (with a diagonal size of 20.3 cm) shows the data needed for terrain-following flights. The TRAM (Target Recognition Attack Multisensor) combination system, consisting of a forward looking infrared set and a laser rangefinder-target designator, was developed to improve accuracy in hitting seaborne and coastal targets. The system is installed on a stabilized platform in a turret unit beneath the fuselage nose. Flight tests of the TRAM began in 1974 and concluded in 1979. All A-6E aircraft presently are equipped with it.

Weapons of the A-6E attack aircraft are accommodated on five attachment points, four under the wing and one under the fuselage, each of which is designed for a maximum load of 1,633 kg. The following are considered standard variants of bomb weaponry: 30 Mk 82 500 pound high explosive bombs suspended on triple-lock holders, or three Mk 84 2,000 pound high explosive bombs and two 1,135 liter external fuel tanks. In addition, the Bullpup guided missile is suspended on the aircraft. Work is being done to outfit it with more up-to-date antiship missiles. In particular, the foreign press has reported arming of the aircraft with the Harpoon antiship missile.

Specialists of the American firm of Grumman believe that contemporary A-6E aircraft will not be able to hit enemy targets having a well organized and powerful air defense system effectively enough in the 1990's, since they will suffer heavy losses in penetrating the air defense. As the foreign press emphasizes, the Intruder aircraft are to be outfitted with reconnaissance equipment and weapons allowing the crew to reconnoiter targets and deliver strikes against them in a stand-off mode in order to increase survivability. The aircraft is to have a radar with high resolution and be armed with air-to-surface guided missiles with long ranges of fire and more advanced guidance systems. The TRAM system partially accomplishes these tasks. Western military experts believe that the aircraft must have guided missiles for close aerial combat or with a medium range of fire as defensive weaponry.

In mid-1984 it was decided to create a modernized A-6F version on the basis of the A-6E attack aircraft meeting requirements of the 1990's to improve the deck-based and marine attack aircraft. According to the specialists, in the modernization it is planned to use components of new equipment and technology (engines, equipment, weapons) with which the F-18 Hornet and F-14D Super Tomcat are outfitted.

The A-6F power plant will consist of two F404-GE-400 (nonafterburning) turbofan engines, each with a maximum thrust of 4,900 kg. The very same engines are installed in the Hornet multirole aircraft. It is believed that the increase in thrust-weight ratio will allow the A-6F aircraft to take off with a somewhat greater weight. In addition, the new engine has less weight, less size and less specific fuel consumption. It is expected that it will significantly improve the aircraft's maneuverability and landing characteristics.

The A-6F on-board equipment is to have high reliability, require small labor inputs for maintenance and be standardized with equipment of other aircraft such as the F-18.

The A-6F radar is to meet general requirements and have high resolution. In this characteristic it approaches the IR sets, but operates at greater range and in all weather conditions. This can be achieved by development and adoption of a radar with an antenna having a synthetic aperture mode. For example, the antenna of the A-6F set has a geometric aperture of 914 mm, which can be increased 100 times in the synthetic mode. Such a radar will allow reconnoitering (detecting) ground (seaborne) and airborne moving targets, and locking on and tracking them at ranges exceeding capabilities of modern radars by twofold. Their prompt detection will make it possible to combat them successfully with air-to-air guided missiles or antiship missiles without entering the effective range of shipboard air defense weapons. In addition, the new radar's resistance to deliberate enemy jamming is to increase approximately tenfold. The new radar also will retain the capability of supporting the aircraft's terrain-following flight. Terrain relief is to be displayed in three dimensions on a special pilot display. The firm of Grumman considered and analyzed radar projects from various firms and gave preference to that of Norden; in late 1984 Grumman concluded a contract with Norden for a five year period covering the development, flight testing (from late 1986) and production of the new radar. In addition, it is planned to equip the aircraft with the new AN/ASN-130 inertial navigation system, a detection receiver, AN/ALQ-165 electronic suppression set, the JTIDS communications and data distribution system equipment, and a digital automatic flight control system. It is also planned to keep the A-6E's TRAM weapon control system.

The equipment is to be controlled with the help of two AN/AYK-14 advanced digital computers and display equipment. All equipment is interfaced over a common bus by means of a digital data distribution system.

The A-6F cockpit will accommodate five multimode cathode-ray tube displays, which will replace eight narrowly specific displays. They will be similar to displays installed in cockpits of the F-18 Hornet and F-14D Super Tomcat. It is planned to install a main electro-optical display and two multimode displays--a vertical display indicator (terrain-following) and horizontal display indicator in place of the optical sight in the pilot's cockpit. The navigator will use three multimode displays--radar data, forward looking IR, and weapon control system (type and number of weapons, bomb release and guided missile launch, and so on). In case one of the displays fails there are provisions for automatic functioning of a back-up system.

In addition to bomb weaponry and the Bullpup missiles, it is planned to arm the A-6F with the AGM-84A Harpoon antiship missile having a long range of fire and an active radar guidance system, and the AGM-65F Maverick (which also can be employed against shore targets) with a short range of fire and an IR guidance system. It is planned to employ the AGM-88 HARM guided missile to suppress enemy electronics. In addition, it is planned to arm the aircraft with two AIM-9 Sidewinder close combat guided missiles or the AIM-120 medium-range missile for its protection.

The program provides for making five prototype models of the A-6F, with flight tests of the first planned for mid-1987 and tests of the rest for 1988. It is planned to begin their series manufacture in 1989 so that by 1995 there will be some 300 aircraft, both of new construction and modernized on the basis of the A-6E, in the naval aviation order of battle.

6904
CSO: 1801/246

HELICOPTER SONARS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 57-59

[Article by Capt 2d Rank V. Surnin and Capt 2d Rank M. Ivanov]

[Text] In recent years the command authorities of the U.S. Navy and navies of other NATO countries have been showing increasing interest in the use of antisubmarine helicopters equipped with dipping sonars for detecting and tracking submarines. This was facilitated to a considerable extent by achievements in microelectronics and by the use of fiber optics, integrated circuits and microprocessors in sonar equipment, which permitted a significant decrease in size and weight of dipping antennas as well as of sonar signal processing and recording equipment accommodated in the helicopter.

In the assessment of foreign specialists, helicopters with dipping sonars provide high effectiveness in hunting submarines in areas with a high noise level (near attack carrier forces and in places of intensive shipping). The primary operating mode of such sonar is active, since it is believed that a single dipping sonar operating in a passive mode does not provide the commander with sufficiently complete information about a target (bearing and distance) in order to attack it.

Helicopters hunt a submarine in the following manner. As a rule, a helicopter hovers at a height of 15 m above the water's surface and lowers the sonar antenna to optimum depth (antennas of the new helicopters submerge to 300 m), at which greatest submarine detection range is provided under given sea conditions. If a target is not detected the helicopter shifts to a new point in the hunt area and so on.

Since use of a dipping sonar complicates piloting of the helicopter, a special automatic control system has been developed for it. Initial data for input to the system are the point for beginning the search, height and speed of flight from one hover point to another, distance between adjacent points for hovering and use of the dipping sonar, and hover height. The pilot can change the initial data if necessary.

Foreign specialists include the following among the most up-to-date dipping sonar of U.S. and NATO navies: HS-12 (France), 195 and HISOS-1 (UK), AN/AQS-13F and AN/AQS-18 (USA).

The HS-12 can operate both in an active and passive mode in carrying out search, detection and automatic tracking of targets. All necessary characteristics of the detected submarine (range, bearing, radial velocity) are determined with the help of the computer.

The set has four range scales: 2, 4, 8 and 16 km. The range of its operating frequencies is 7-20 kHz. Maximum submergence depth of the sonar antenna is 300 m. With light weight and small dimensions, the HS-12 is installed in the Lynx antisubmarine helicopters. It is in the inventory of navies of France, Sweden and the Netherlands.

The 195 dipping sonar (Fig. 1 [figure not reproduced]) operates on a frequency of 10 kHz and, along with other electronic equipment of the helicopter, permits antisubmarine missions to be accomplished. Its operation is supported by the AQS-902 computer and certain auxiliary devices--bathythermographs with a recorder which graphically displays sea conditions, and indicators of cable-line deflection and length. The antenna of the 195 set can submerge only to 75 m, i.e., to a considerably lesser depth than for contemporary sets. This dictates its more limited capabilities of searching for targets under adverse sea conditions. All data coming from the dipping sonar and electronic equipment as well as navigational data are displayed on a tactical situation board.

The set is in the inventory of UK Navy Sea King helicopters.

Great Britain recently created the HISOS-1 dipping sonar for the Lynx helicopters and, in the future, for the EH-101 being jointly developed by Italian and British firms. Foreign specialists emphasize that this set's data processing system will be able to receive data not only from the dipping sonar, but also from sonoradio buoys, providing antisubmarine helicopters with greater operational flexibility.

The HISOS-1 has a more advanced antenna than the 195 set (Fig. 2 [figure not reproduced]); it descends to a depth of up to 300 m and has a greater submarine detection range.

The AN/AQS-13 has been in the inventory of U.S. Navy helicopters and those of a number of other NATO countries for many years. Its latest modification (AN/AQS-13F) operates on frequencies of 9.5-10.5 kHz, in a circular scan, in active and passive modes. It is expected that the submergence depth of the antenna will reach 450 m. In contrast to others, it has a signal processing unit for increasing the effectiveness of dipping sonar operation in shallow water areas. The AN/AQS-13F is a digital system which uses an APS [adaptive processor sonar] processor. The set has considerably less size and weight than previous modifications.

In addition to the AN/AQS-13F, Bendix developed the AN/AQS-18, which has been placed aboard helicopters of the FRG Navy. In the active mode this set can operate on one of three working frequencies in the 9.2-10.8 kHz band. The antenna submergence depth reaches 300 m which, as foreign specialists note, is quite sufficient for employing FRG Navy antisubmarine helicopters in the North Sea. The AN/AQS-18 has six range scales: 1, 3, 5, 8, 12 and 20 km.

According to foreign press data, the United States and other NATO countries presently are developing helicopter dipping sonar with more advanced equipment and better performance data.

6904
CSO: 1801/246

U.S. NAVY SONAR SURVEILLANCE VESSELS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) p 60

[Article by Capt 2d Rank (Res) V. Mosalev]

[Text] "Stalwart" Class vessels (see color insert [color insert not reproduced]) are entering the inventory of the U.S. Navy Military Sealift Command. They are fitted with the SURTASS (Surveillance Towed Array Sensor System) towed long-range sonar submarine detection system and are intended for patrol service in ocean areas outside the coverage of the SOSUS fixed long-range sound surveillance system.

The vessel has the following performance characteristics: full load displacement 2,400 tons; length 67.5 m, beam 12.8 m, draft 4.6 m; speed in transit 11 knots, in patroling 3 knots; range 2,000-3,000 nm (at a speed of 11 knots) and 6,400 nm (at 3 knots); endurance 90 days; crew of 30 (nine officers, ten navy servicemen, 11 civilian employees). During a year's time the vessel may spend 300 days on patrol at sea.

The main propulsion plant consists of four 2,200 hp diesels which turn two four-blade propellers 2.46 m in diameter. The vessel has a bow thruster powered by a 550 hp electric motor and is equipped with a diesel-electric installation which includes four 600 kw diesel generators, two main dc electric motors and switch gear. The diesel generators supply the on-board circuits as well as four electric motors of the towed antenna hydraulic winch with electrical energy through three 500 kw transformers. The system acoustic equipment is supplied by two converters operating at frequencies of 60 and 400 Hz.

The TB-16/BO towed antenna 1,829 m long (1,220 m according to other data) with neutral buoyancy is a linear sonar antenna array containing 80 compact hydrophones which receive signals at eight low acoustic frequencies. The antenna is towed at various depths depending on sea conditions beneath the temperature discontinuity layer at a speed of 3 knots, which provides for least interference to the receiving antenna from the ship's power plants. The tow cable 1,800-2,000 m long contains 60 paired conductors for transmitting signals from the hydrophones. It is subsequently planned to use a coaxial cable in place of these conductors. According to foreign press data, the system will allow direction finding of underwater noise-producing objects at

ranges of around 550 km and classification of submarines at a distance of up to 140 km.

It is planned to analyze the sonar noises and signals received by the vessel antenna at a shore data processing center, to which they will be transmitted (the transmitter has 4 kw output) via a satellite system in the radio frequency range of 5.2-10.9 GHz using digital communications. The satellite communications system antenna, stabilized on three axes, is covered with a wind and spray resistant cover and installed on a tripod mast amidships. The antenna system weighs around 220 kg.

The American press reports that in view of the rather high survivability of the SURTASS system, the U.S. Navy leadership regards it as very promising, and construction of vessels for it has been made third in priority (after the "Los Angeles" Class SSN's and "Ticonderoga" Class guided missile cruisers) among all combatant and auxiliary vessels of the general purpose forces. It plans to build 18 sonar surveillance vessels (12 "Stalwart" Class single-hull vessels and six catamaran vessels with small waterplane area). The latter will have a length of 92 m, a beam of 41.5 m, a speed of 9 knots and a crew of 84.

6904
CSO: 1801/246

U.S. MILITARY BASES ON UK TERRITORY

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 6, Jun 86 (signed to press 9 Jun 86) pp 61-64

[Article by Col A. Alekseyev]

[Text] Relying on force in conducting its foreign policy course, the U.S. military-political leadership is constantly building up a military presence far from the American continent. This concerns in particular the present policy of "neoglobalism," an important element of which is an expansion and improvement of U.S. military bases on foreign territories. They are intended above all for preparing an attack on the Soviet Union and other countries of the socialist community, suppression of national liberation movements, armed intervention in the affairs of developing countries and assistance to antipopular regimes welcome to Washington.

Military installations in Western Europe, including on the territory of Great Britain (see diagram), with which the United States maintains "special relations," occupy a special place in the global network of American bases. The basis of Anglo-American cooperation is extreme antisovietism; a unity of views of the military-political leadership of these countries on the use of force as the principal means of combating world socialism; and the readiness of the British conservative government for joint military actions with the American administration beyond limits of the NATO "zone of responsibility." Relying on partnership with the United States, British ruling circles seek to prevent a further weakening of their position in the capitalist world, and they take an active part in shaping the most important lines of NATO policy.

The Tory government follows in the channel of Washington's aggressive military-political course. They actively support the deployment of new nuclear first strike missiles in Western Europe and were first to join the American "star wars" program.

Great importance is attached to the territory of Great Britain in military plans of the U.S. and NATO command authorities. It is viewed both as an important support base for conducting military operations in the Atlantic and as a rear base for NATO armed forces located in Europe. Therefore even in peacetime the territory is being operationally prepared not only in the interests of national armed forces, but also with consideration of the possibility of deployment of units [soyedineniye and chast] of NATO's joint

air forces (American above all) in the British Isles, and support to transit troop and freight movements from America to Europe.

The U.S. Air Force has been on UK territory for over 40 years. At the present time there are some 300 U.S. Air Force combat aircraft based in the British Isles; this is approximately half of the total number of American combat aircraft stationed in European countries of NATO.

According to foreign press data, seven British air bases have been placed at the disposal of the U.S. Air Force for permanent basing: Mildenhall, the location of headquarters of the U.S. 3d Air Force, 306th Strategic Air Wing and 513th Tactical Transport Wing; Lakenheath (48th Tactical Fighter Wing of four fighter squadrons); Upper Heyford (20th Tactical Fighter Wing, three fighter squadrons); Bentwaters (four squadrons of the 81st Tactical Fighter Wing); Woodbridge (two squadrons of the 81st Tactical Fighter Wing); Alconbury (17th Strategic Reconnaissance Wing and 10th Tactical Reconnaissance Wing of two squadrons, one of which is a training squadron); and Fairford (11th Strategic Air Group).

As the foreign press notes, in case the situation becomes aggravated it is planned to place another two air bases--Sculthorpe and Wethersfield--at the disposal of the U.S. Air Force. In addition, it is planned to give American aviation an opportunity to use 10-12 other airfields, among them the airports of Ringway (Manchester) and Heathrow (London), Royal Air Force air bases of Northholt, Finningley and others.

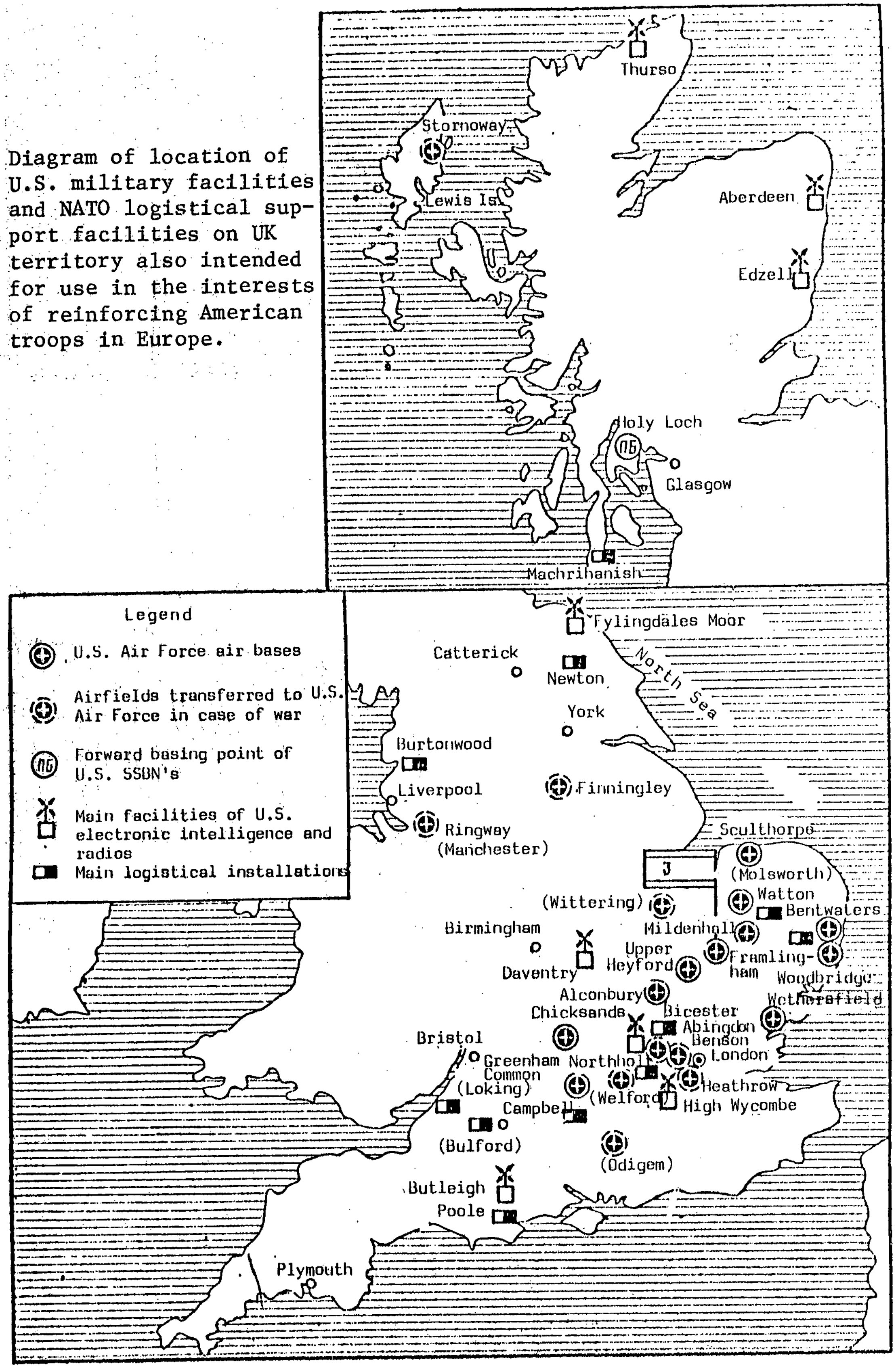
According to British press reports, the NATO bloc is financing the reconstruction of a forward air base at Stornoway (Lewis Island), which is intended for U.S. land-based patrol aircraft.

There are large MTO [logistical support] points, including several nuclear weapon depots, at American air base locations.

The first detachment of American land-based cruise missiles in Europe was deployed in Great Britain in late 1983. Construction has ended on administrative buildings and reinforced concrete missile storage areas at the U.S. base at Greenham Common (85 km west of London), and preparatory work has begun at the Molsworth airfield (100 km north of London). Presently at least 48 missiles of the 501st Tactical Missile Wing are in place. It is planned to deploy a total of 160 missiles by 1988: 96 at the base at Greenham Common and 64 at Molsworth. The cumulative power of the warheads will be 32,000 KT, which is almost equal to 1,800 of the atomic bombs dropped on Hiroshima in 1945.

According to western press reports, a flight [otryad] of four mobile transporter-launchers (four missiles on each) and two launch control points (the first, main point, supports the launch of all 16 missiles and the second is in reserve) is the primary cruise missile weapon subunit. Several launch positions are chosen in advance for each flight over 100 km distant from the permanent locations. Some of the cruise missiles are ready for launch as part of alert forces of the NATO joint air forces.

Diagram of location of U.S. military facilities and NATO logistical support facilities on UK territory also intended for use in the interests of reinforcing American troops in Europe.



The foreign press notes that American air bases and land-base cruise missile locations are concentrated in the southeastern part of Great Britain and weapons from there are aimed primarily against the Soviet Union and other socialist states.

The American Navy has a forward basing point for nuclear-powered strategic submarines at Holy Loch, which continues to be improved. A new berth, loading-unloading dock and depot facilities are being built. The headquarters of the U.S. Navy command in the Eastern Atlantic is in London.

The U.S. Army is not stationed on UK territory, but periodically takes part in military exercises for the purpose of learning the possible theater of military operations.

There is broad Anglo-American cooperation carried on in the area of reconnaissance, governed by a 1947 agreement, based on which both countries' electronic intelligence networks were united to a certain extent. Several American electronic intelligence facilities (Chicksands, Fylingdales Moor, Edzell and others) and radio stations operate on UK territory. As the foreign press notes, Washington has worked out a plan for building a powerful American radar near Fylingdales Moor for surveillance of airborne and space objects in the North Atlantic and the Norwegian and Baltic seas. The new radar will have a phased array antenna and its output will exceed by many times that of large radars defined by the Soviet-American Treaty on the Limitation of Antiballistic Missile Systems.

The largest logistical support facilities of American forces on UK territory are depots for military equipment, ammunition, and ground forces equipment in the vicinity of Burtonwood near the city of Liverpool. A large logistics base is being built near Campbell Airfield for storing aircraft spare parts.

A program has been developed for building some 15 500-bed military hospitals for use only in wartime. They include hospitals at Campbell and Newton for the U.S. Air Force, at (Bulford) for the American Army and at (Loking) for the Navy.

According to foreign press data, there is an overall total of up to 50 different U.S. military facilities on UK territory. It is assumed that their number will increase considerably in the near future.

The total strength of U.S. Armed Forces in Great Britain exceeds 30,000 persons, with the Air Force accounting for over 85 percent of them. As the western press reports, on the basis of the 1983 Anglo-American agreement, in case of war UK military and civilian resources will be placed at the disposal of the United States. It is planned to move a considerable contingent of American servicemen to the British Isles. In addition, support units and subunits of the U.S. Armed Forces in Great Britain will be augmented by personnel from the local civilian populace.

The British command lately has been giving increasing attention to problems of organizing security of military installations, including American military bases. The largest exercise since World War II named Brave Defender was

conducted on UK territory in September 1985. One of its primary missions was to work out matters of organizing security and defense of important military installations against actions by "sabotage and subversive elements." Included among the important facilities were several U.S. military bases (particularly air bases at Bentwaters and Woodbridge and logistics depots at Burtonwood). American servicemen also took part in the exercise. An overall total of some 65,000 officers and men of regular and territorial forces, including up to 1,000 from U.S. Armed Forces stationed in Great Britain, were active in the exercise.

The militaristic antisoviet foreign policy course of the Tory government is encountering ever greater resistance on the part of the progressive British public and opposition political parties. Thousands of men and women joined in the antiwar movement; they are acting against the stationing of American cruise missiles in the country and are demanding an end to the presence of the American military in the British Isles.

But the conservative government continues to adhere to an anticommunist foreign policy course aimed at achieving strategic superiority of the NATO bloc over the Warsaw Pact Organization. In December 1985 Great Britain signed an agreement with the United States on participating in development of the research portion of the American "star wars" program.

Such actions by UK ruling circles obligate Soviet soldiers to keep a vigilant watch on military preparations being conducted in the country and on provocative activities of American Armed Forces there, and to steadfastly increase their political vigilance and combat readiness.

6904
CSO: 1801/246

END